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CANADIAN MACHINERY AND MANUFACTURING NEWS

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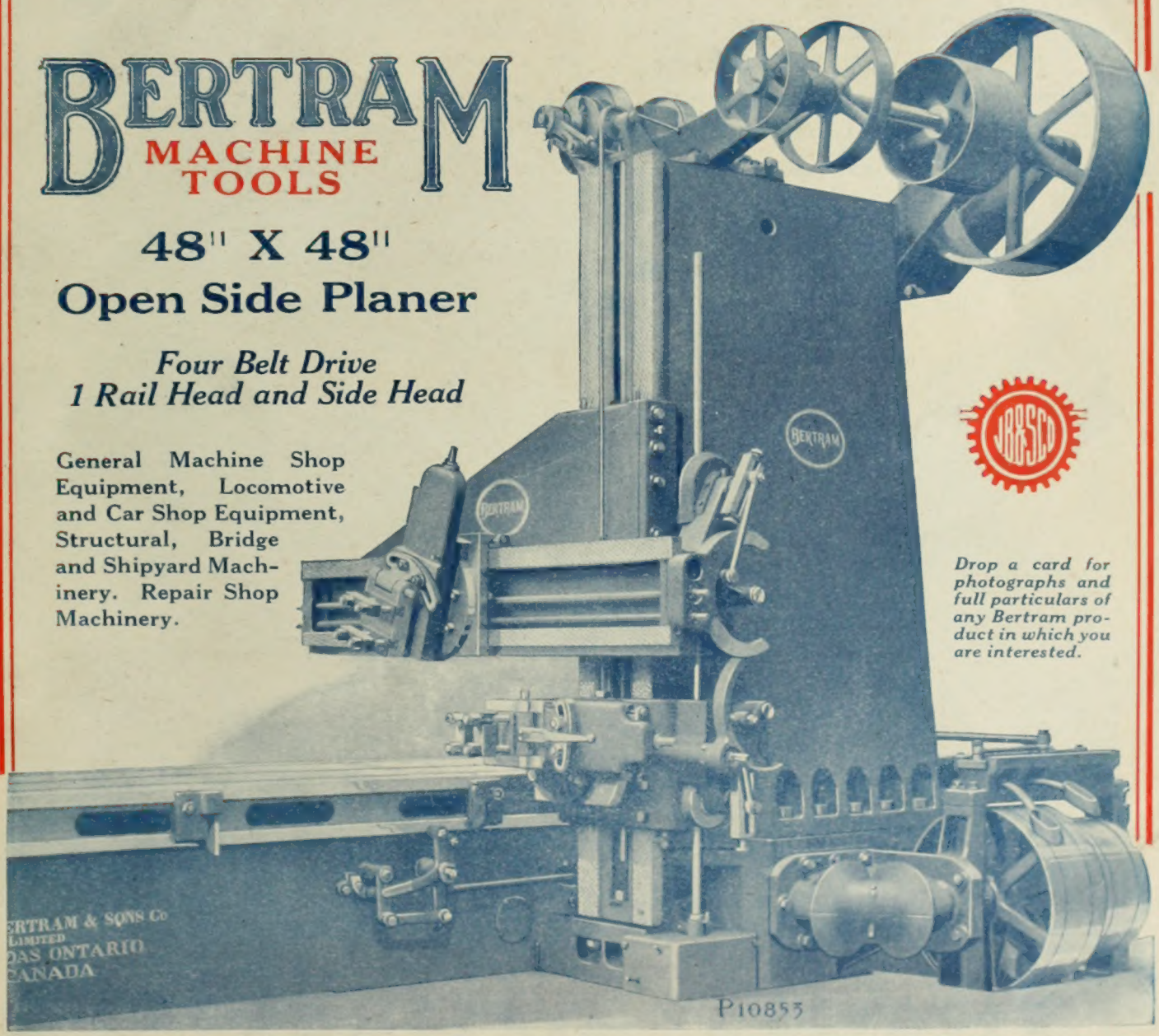
BERTRAM
MACHINE TOOLS

48" X 48"
Open Side Planer

Four Belt Drive
1 Rail Head and Side Head

General Machine Shop Equipment, Locomotive and Car Shop Equipment, Structural, Bridge and Shipyard Machinery. Repair Shop Machinery.



Drop a card for photographs and full particulars of any Bertram product in which you are interested.

The John Bertram & Sons Co., Limited
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MONTREAL 723 Drummond Bldg. | TORONTO 1002 C.P.R. Bldg. | VANCOUVER 609 Bank of Ottawa Bldg. | WINDSOR Davis Bldg. | WINNIPEG 1205 McArthur Bldg. | HALIFAX Roy Bldg.

You can't help noticing the good qualities of

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Their free cutting qualities, their extreme accuracy and their extraordinary ability to outlive others distinguish them.

The con-eccentric relief—a distinctive P & W feature—is the secret of their goodness. One-third of the cutting edge is concentric. The remaining two-thirds has eccentric relief. Taps can be sharpened at the only correct point—on the face of the cutting edge. Sharpening in no way affects their size.

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VANCOUVER, B.C. Equipment Co.

"Some Tap"

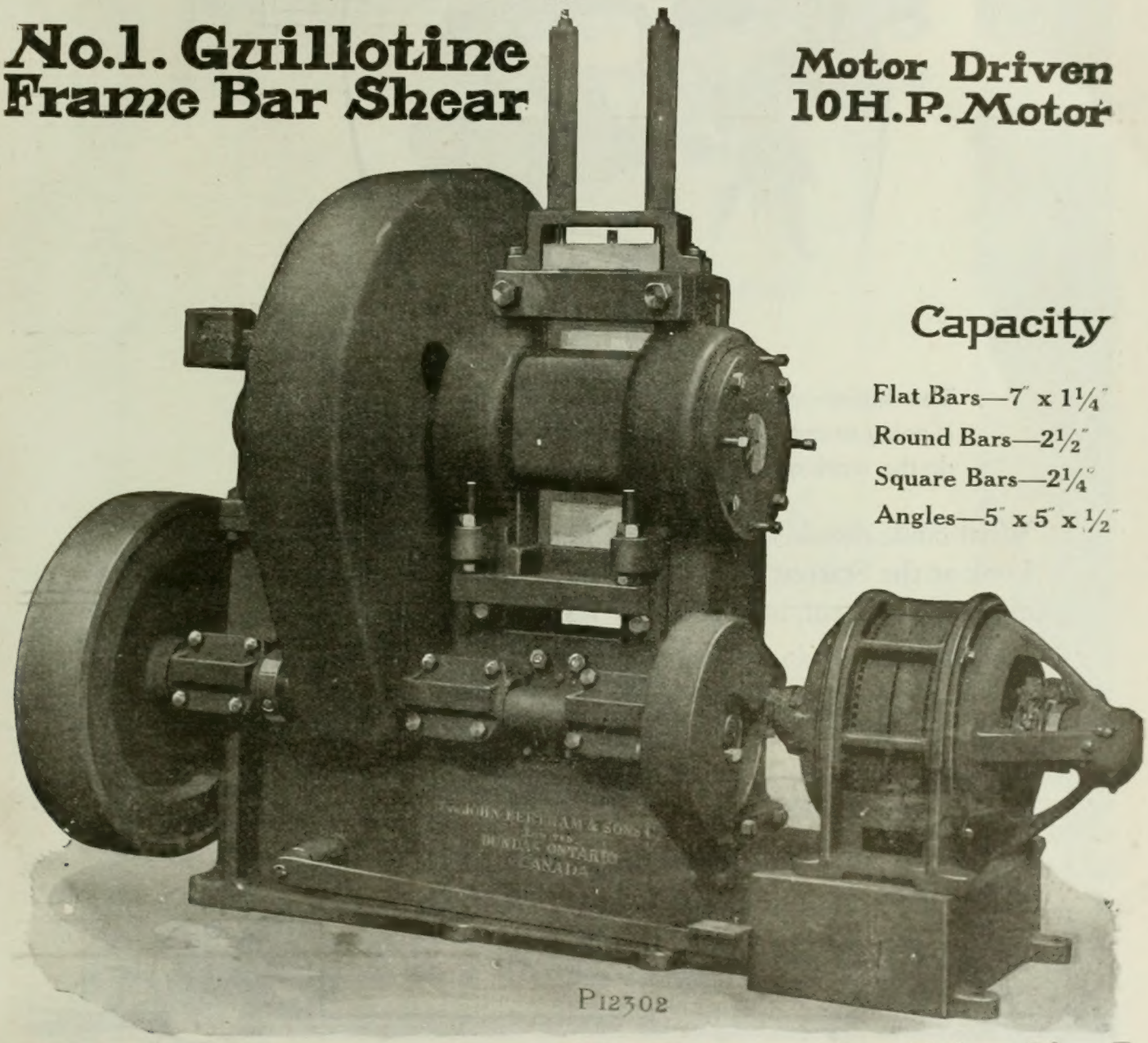
PRATT&WHITNEY

The BERTRAM Page

MACHINE TOOLS

No. 1. Guillotine Frame Bar Shear

Motor Driven 10 H.P. Motor



Capacity

Flat Bars—7″ x 1¼″
Round Bars—2½″
Square Bars—2¼″
Angles—5″ x 5″ x ½″

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If interested tear out this page and place with letters to be answered.

You know—every machinist knows—the material he is going to cut—but how many know what blade will do the work quickest, easiest, most economically?

What blade should this man be using? He's cutting Brass. Look at the Starrett Hack Saw Chart, under the name of the material to be cut, and you find numbers 103 and 112.

If your hack saw frame will take a 12-inch blade use the No. 112 Saw. Why? Because it's a heavier, sturdier blade—and you can cut faster with it. If you use the No. 103, the only difference is that it's a thinner, narrower blade.

But whichever you use—always follow the Starrett Hack Saw Chart, and use Starrett Hacksaw Blades.

Send for Catalog No. 22 "3" and a copy of the Chart

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
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STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

Use Starrett Hack Saws

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and Manufacturing Equipment

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(All Sections from 12 lbs. to 100 lbs. per yard)
SPLICE BARS
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IRON, BRASS AND BRONZE CASTINGS
All of these steels we supply in
HOT ROLLED BARS
We also furnish in
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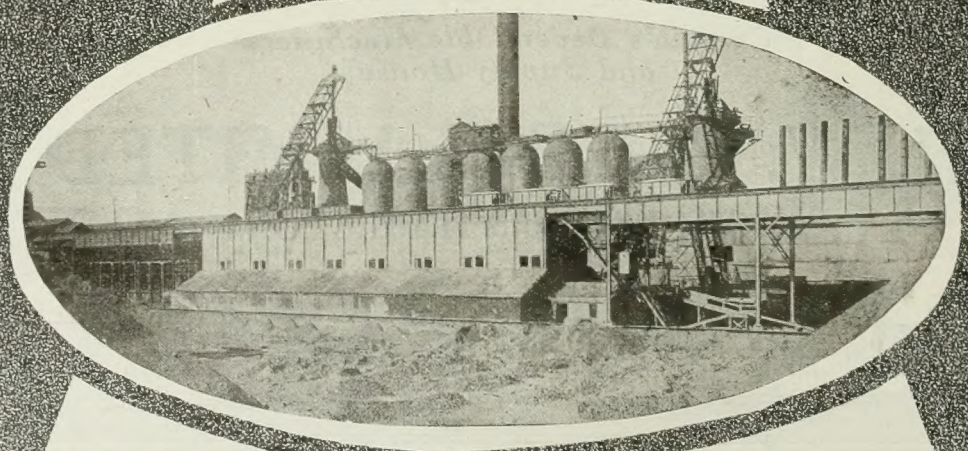
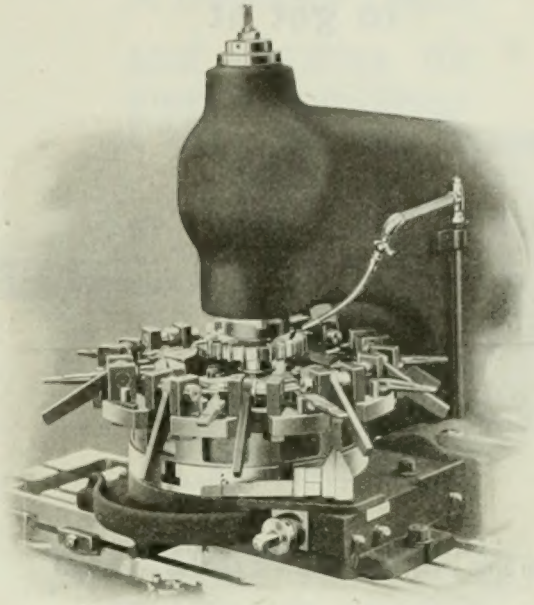
The quality of our product is of the very best—and is exclusively steel made by the Open Hearth Process, and can be furnished in all grades, from the softest rivet stock to high carbon special spring material.

Order from us and you'll get both quality and prompt service. A trial is convincing.



MILWAUKEE MILLING MACHINES



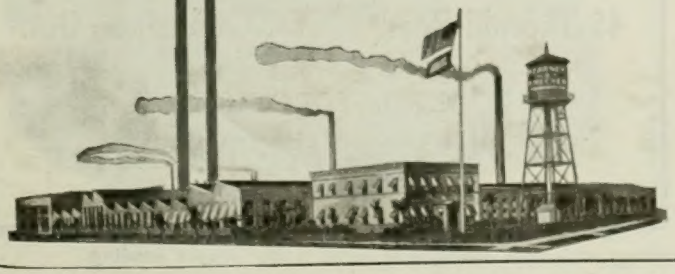
Continuous milling of 10-inch adjustable wrenches on a Milwaukee Vertical Milling Machine. These parts are turned out at the rate of 3,000 a day and the finished surface bears a constant and accurate relation to other selected points on the part.

Rapid, Economical Milling

Manufacturing milling by the continuous process is an advanced step in milling machine practice that is worthy of the serious consideration of the management of any plant. The motion in this milling process is continuous. It is reasonable, therefore, that in this way maximum production is secured. This sort of milling is most desirable in the machining of parts in large quantities. The rotary table with chucking fixture holding the work revolves, and the cutter is in operation and in the work at all times. The operator removes the finished piece and puts another unmilled one in its place.

Milwaukee Vertical Milling Machines are particularly well adapted to continuous milling. The spindle is adjustable for wear only as sufficient adjustment can be obtained by the adjustment of the knee alone, the same as it is in the horizontal type milling machines.

Have you any milling that would be well adapted to continuous milling? Let us help you.



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MILWAUKEE, WIS., U.S.A.

Canadian Representatives:

Williams & Wilson, Ltd., Montreal
F. F. Barber Machy. Co., Toronto
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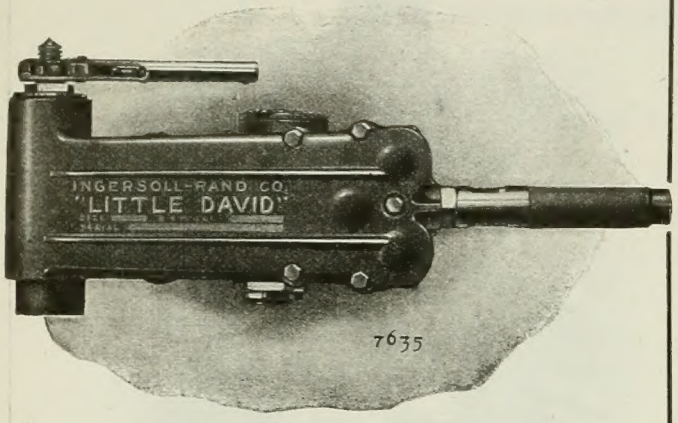
A Handy Drill

for the place that's hard to get at



Number 9
"Little David" Close Quarter Drill
will drive a 3 in. Twist Drill or a 2 in. Tap or Reamer.

"Little David" Close Quarter Drills will save you time and money for drilling, tapping, reaming, or running down nuts and studs in cramped places. They can be used right up against a lug or boss on a casting, or wherever space is scanty and ordinary pneumatic drills are of little use.

"Little Davids" contain less parts than used in other drills of this type, and, being simpler and more rugged, will last longer. Power is transmitted from the pistons to the spindle by three simple rocking levers, and as there are no chains, gearing, or other "frills," the air consumption is less than that of any other drill of equal size and power.

"I'd just as soon think of trying to get along without a socket wrench for my car as to do without my 'Little David' Close Quarter Drill," an enthusiastic user told us not long ago.

Made in two sizes.

"Little David" Close Quarter Drills are members of a family of Canadian built Pneumatic Tools. Write for Bulletins describing the entire line.

Canadian Ingersoll-Rand Co.,
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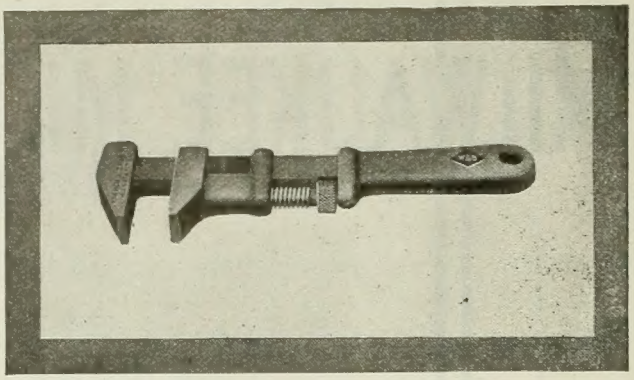
Cobalt Winnipeg Nelson Vancouver



WILLIAMS' Superior Wrenches

"W & B" Railroad Special Wrenches are indestructible — under gruelling punishment their ease of action and accuracy of fit are maintained. They are the most durable screw wrench made.

Seven sizes, 6 to 21 inches, with maximum capacity of 3 15/16 inches. Guaranteed. At your dealers'.

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often cheaper than castings
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—the best for varied work

General manufacturing plants prefer the **Rockford Miller** because they require a machine which they can depend on to do any work within its range to the complete satisfaction of the inspection department.

Simplicity of operation and **absolute rigidity under every condition** are distinctively **Rockford** features. They have made this the very best machine for general manufacturing.

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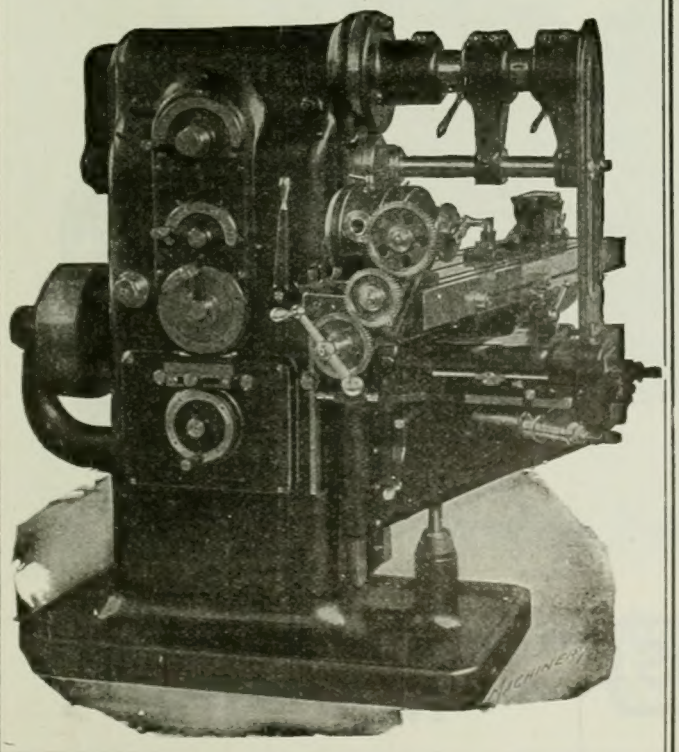

FREE

A Book of Facts and Figures on FIRE BRICK

You should have this handy little reference book—costs **you nothing.** It gives valuable hints on how to get the best results from the fire brick you use in your furnace linings, cupolas, boiler arches and all fire brick masonry. In addition to this there are tables showing the number of brick required to make certain size linings, and comparison of various thermometer scales, circumference and areas of circles, in addition to weights of various materials.

Let us have your name and address now, while you have it in mind.

ELK FIRE BRICK CO.
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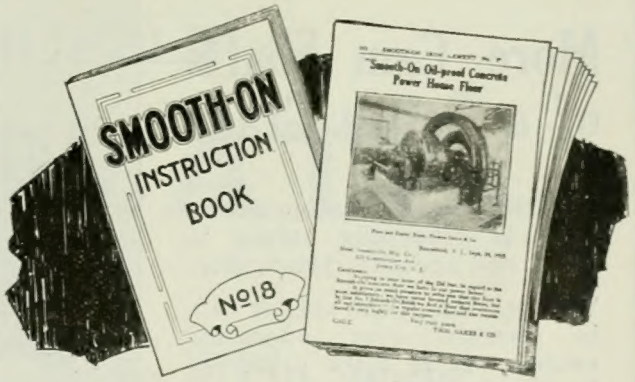

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This latest edition has been completely revised—new material inserted, new repair problems described.

The Smooth-On Instruction Book No. 18 is the most valuable book of its kind. Its 144 pages contain sound, practical and money-saving advice on various power plant and boiler room repairs. Its compilation has been contributed to by engineers the country over.

Your copy is waiting—all we want is a word from you and we will send it along.

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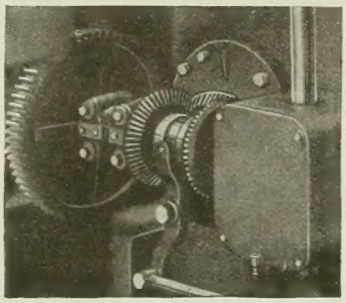
THE JOHNSON FRICTION CLUTCH

Clutches for Reversing Functions



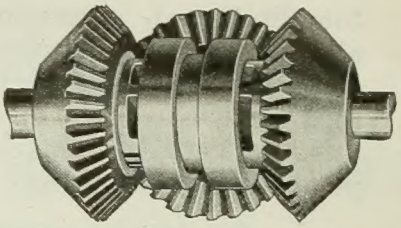
Johnson Clutch Installation on Newton Milling Machine

A reversing clutch is a very common requirement on machinery, and one which is encountered in many different forms. Whatever the situation may be, a Johnson Clutch offers the best method of handling it.

The bevel gear assembly shown here is one of the ways in which a Johnson Double Clutch is frequently applied for reversing functions. Many of the best machine tools are equipped in this manner.

Write for our Yellow Catalog and Booklet,

"Clutches As Applied To Machine Building."



Double Clutch in Nest of Bevel Gears

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CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

More Cam Shafts of a Better Grade

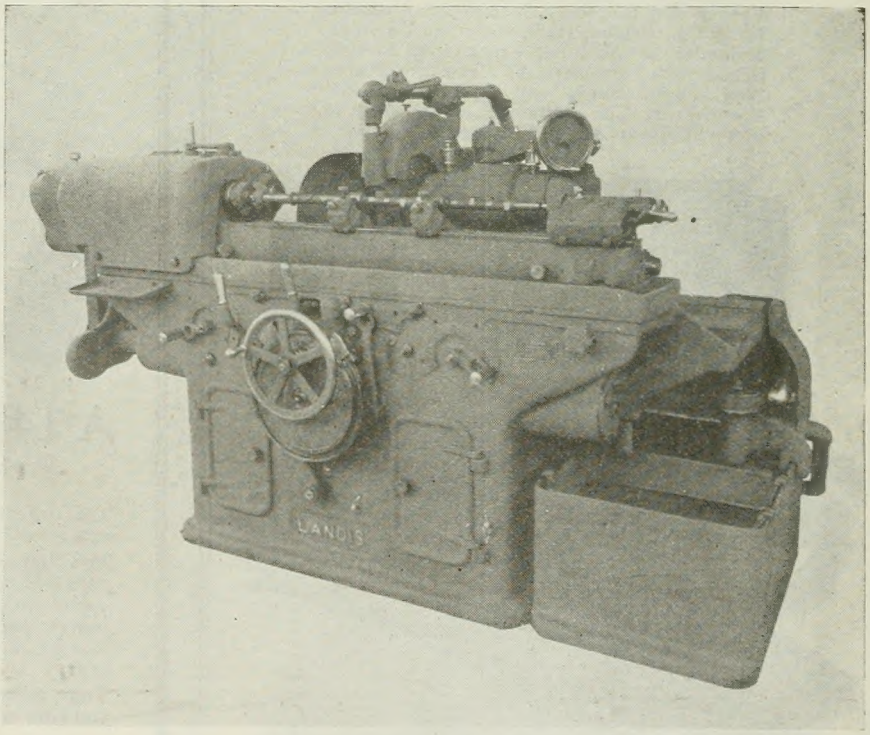
LANDIS design and performance is especially suited to rapid and accurate production.

The location of the master cam is directly over operating center. It is fully protected from water and grit.

The LANDIS has removed all chance from cam grinding by insuring precise adjustment and easy operation.

The makers of high-grade motors depend on the LANDIS.

You'll see why when you look up the details.



Landis Tool Co.

Main Office and Works:

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New York Office: 50 Church Street

LANDIS

Cam Grinding Machine

CANADIAN STEEL FOUNDRIES LIMITED

AMONG OUR PRODUCTS

O. H. STEEL
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- Complete Intersection

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STEEL PLATE

—IN—

Universal Edge - up to 40 in. wide

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Any Thickness **Any Lengths**

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Dominion Foundries & Steel, Limited

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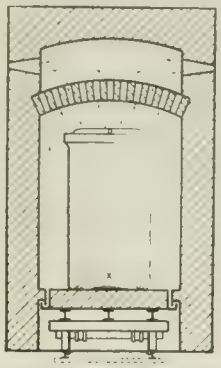
USES and LIMITATIONS

of

Car Type and Car-and-Ball Type Furnaces

W. S. ROCKWELL CO. INDUSTRIAL FURNACES NEW YORK

are clearly defined in Bulletin 222-T



Irregular heating of high charge in car furnace, showing tendency to overheat at the top and formation of cold zone (X) at bottom due to comparatively cold hearth

Typical installations are shown to illustrate –

The applicability of car type and car-and-ball type furnaces to the heat-treatment of material that cannot be advantageously handled in other types of furnaces.

Factors governing selection of the type (car or car-and-ball) best suited to individual manufacturing requirements.

Difference in design of each type.

Influence of unequal cooling on the quality of finished product.

In brief, this bulletin is a discussion of principles which will appeal to those interested in furnace design, loading and handling methods, heat generation and utilization, etc.

Write for Bulletin 222-T

W. S. ROCKWELL COMPANY

We make Industrial Heating Furnaces for every requirement

Furnace Engineers and Contractors

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"FURNACE AND FUEL TO SUIT CONDITIONS"

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HIGH SPEED STEELS

For superior cutting power:

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For all Purposes.

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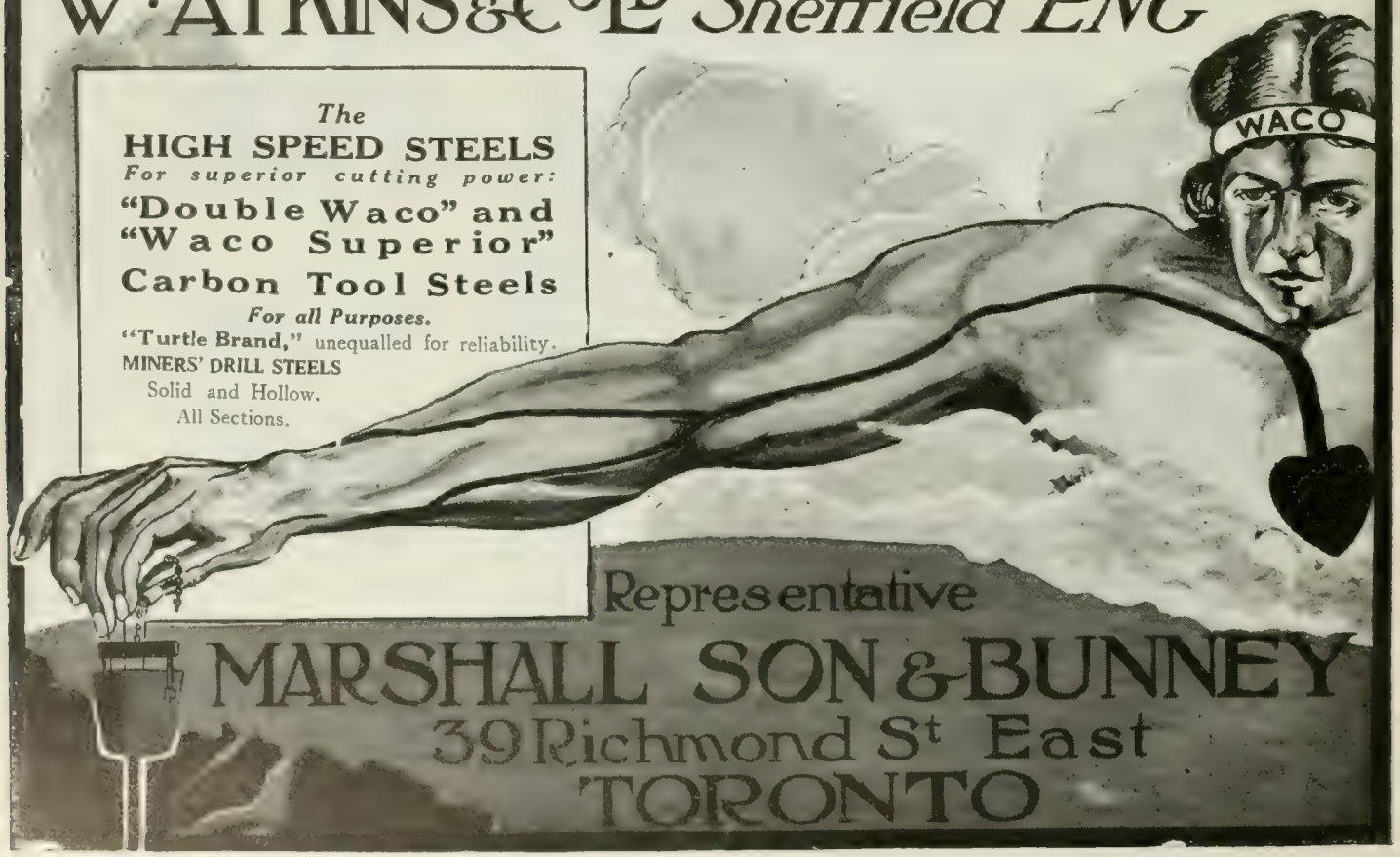
MINERS' DRILL STEELS

Solid and Hollow.

All Sections.



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TRAHERN
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Coolant Pumps

TRAHERN Coolant Pumps are built as regular equipment into leading Machine Tools. They are easily connected to any machine and will pump any liquid not containing grit.

Deliver 16½ G.P.M. at low speed; smooth, forceful stream free from pulsation. Reverse automatically, supply may be shut off at discharge without stopping pump; operate against 100 lbs. pressure if desired. Will not lose prime when properly installed.

Write for our Bulletin 44, giving details.

TRAHERN PUMP DIVISION
Geo. D. Roper Corporation
ROCKFORD, ILL.,
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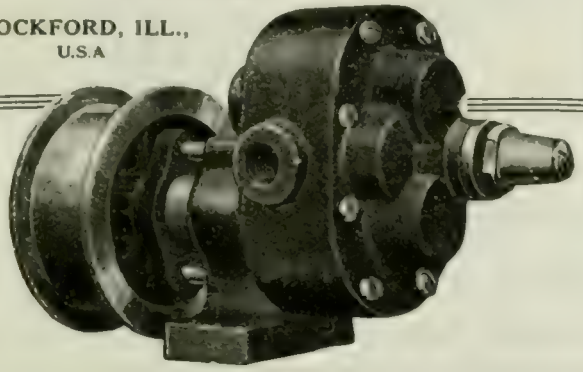

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High Carbon Steel
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QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

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OWEN SOUND, ONTARIO
ESTABLISHED 1860

STEEL *for*
Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

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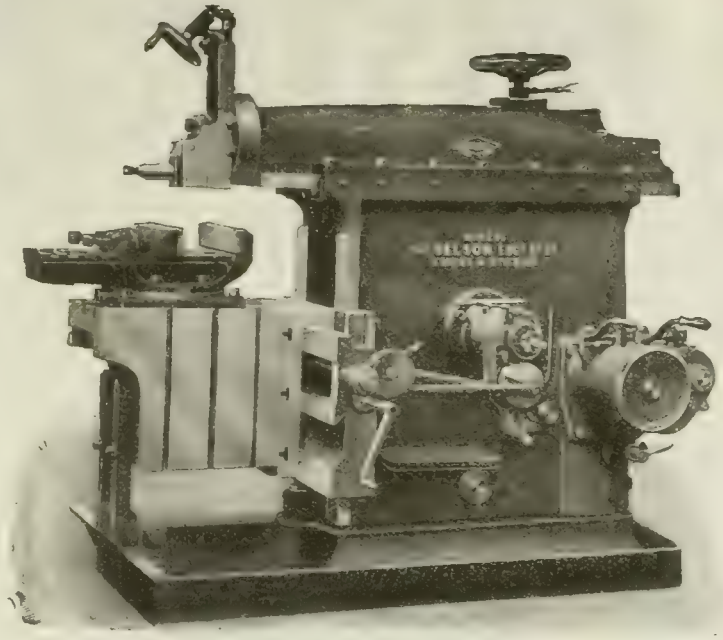
Steel Ingots
by the
HARMET
Liquid Process

The "SELSON" Shaping Machines



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Sizes
10, 13, 17, 25, and 30"

If you want the finest Shaper ask Selson for full particulars.

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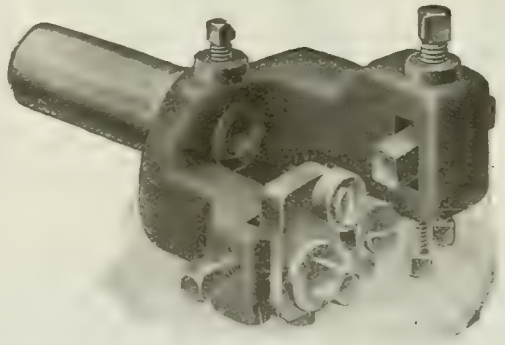

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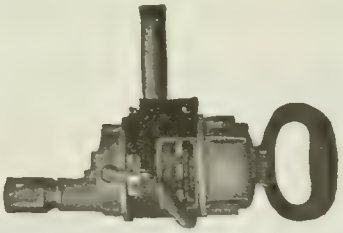
ENGLAND

U. S. Electric Drills and Grinders
Save Time, Labor and Money



They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

3 SIZES
3-16 in., W.G.T., 6 lbs.
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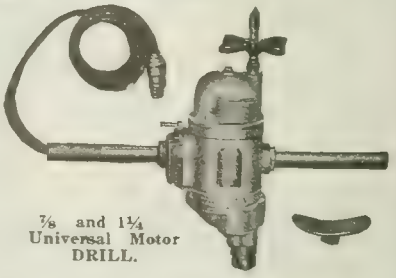
All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



⅜ and 1¼ Universal Motor DRILL.

For Sale By
The Canadian Fairbanks-Morse Co., Limited
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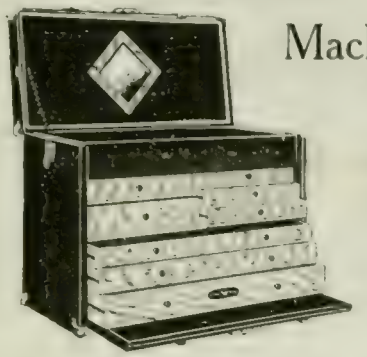
We have in stock for immediate shipment the highest grade Bar Iron, **Black and Galvanized Sheet Iron, Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.**



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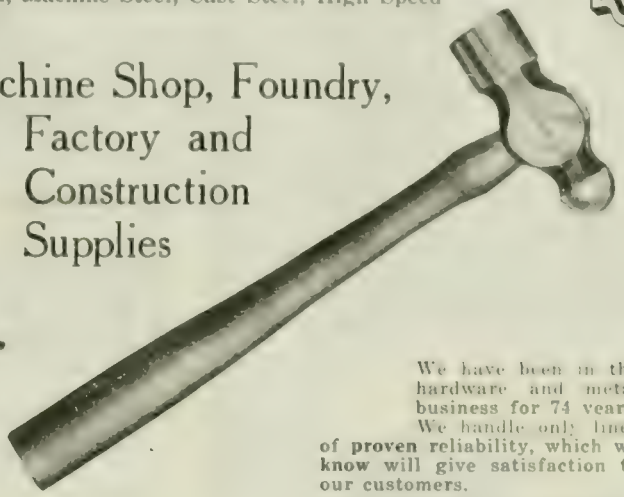

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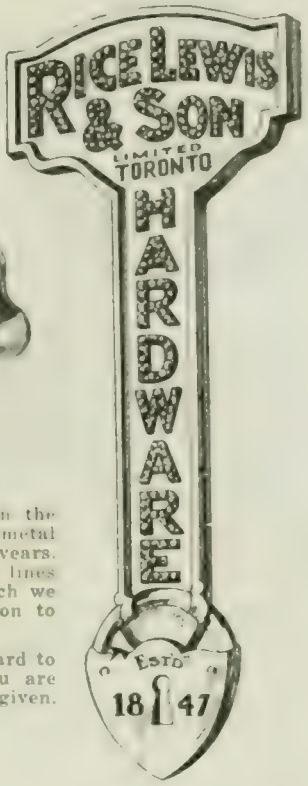

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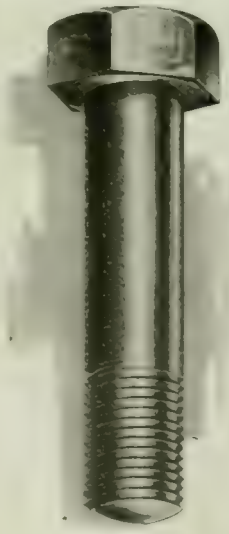

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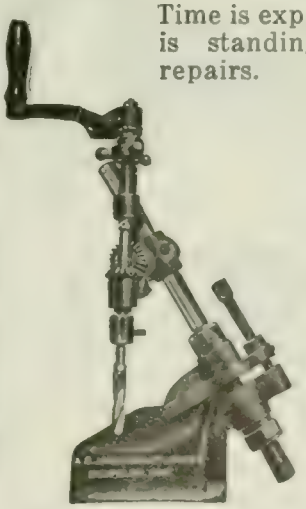

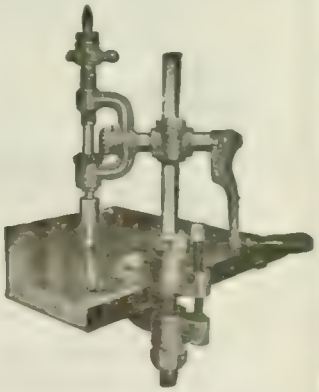

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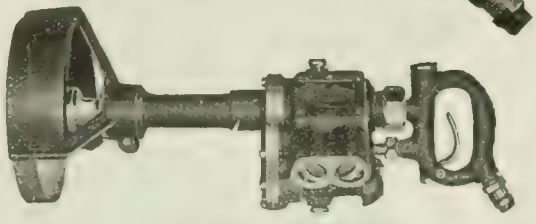

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Carrying On By Marking Time

By J. K. Munro

HAY foot—straw foot—left foot—right foot—and never getting anywhere! That's J. K. Munro's view of the Parliament at Ottawa during March. Crerar and Lapointe are the only men who have really said anything, in "J. K.'s" opinion. After a survey of the Dominion Mr Munro prophesies that there will be a Farmer Government, sure, in 1922—and probably supported by several French-Canadians.

And the Budget—"it is not likely," says Canada's leading political pundit, "that it will be a very sweeping document. It will likely provide for a sales tax of about one per cent, to make up the hundred million by which the estimates exceed the revenue, and the excess profits tax will likely be wiped out. That's about all."

John Barleycorn and Jack Canuck

It's a hard question for the man-on-the-street to answer, How Dry is Canada? But Charles Christopher Jenkins has studied the question from all angles, and you will find his article extraordinarily informative and—in the light of Ontario's vote April 18—very timely.

"For Sale For a Song."
By Agnes C. Laut.

The question whether Oriental labor will solve some of our problems is here discussed.

"From Ontario to Tin Pan Alley."
By Geoffrey O'Hara.

A Canadian wrote "K-K-Katy" and also a song for Caruso. He tells how he won success.

"The Drama of Our Great Forests."
By Arthur Heming.

A further instalment of the artist-author's adventures with Oo-koo-hoo in Canada's primitive Northland.

"As a Man to His Friend."
By William Merriman Rouse.

A stirring story of the Ottawa Valley, of two lumberjacks, an actress and a barber.

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What do the occupants of an Old Woman's Home think of, as they wait for the "Reaper"? A poignant story with a surprise climax.

"Pawned."
By Frank L. Packard.

John Bruce recovers his strength, woos Claire Veniza—only to find her falling into Dr. Crang's clutches.

"Why Have We Juvenile Crime?"
By Ethel M. Chapman.

A timely account of Juvenile Delinquency and the Big Brother Movement.

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Unemployment Crisis in Britain .....R. H. Tawney
Optimistic About the League .....Lord Robert Cecil
Ideal British Cabinet .....London Magazine
Common Sense Bridge .....A. E. Manning Foster
Kipling's "Lurgan Sahib" Dies .....London Times
U.S. a Bar to Naval Disarmaments .....Scientific American
A Winged Torpedo Boat ....."Tin Fish"
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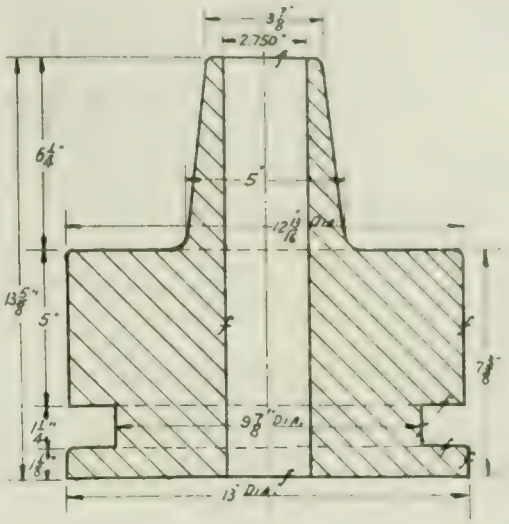

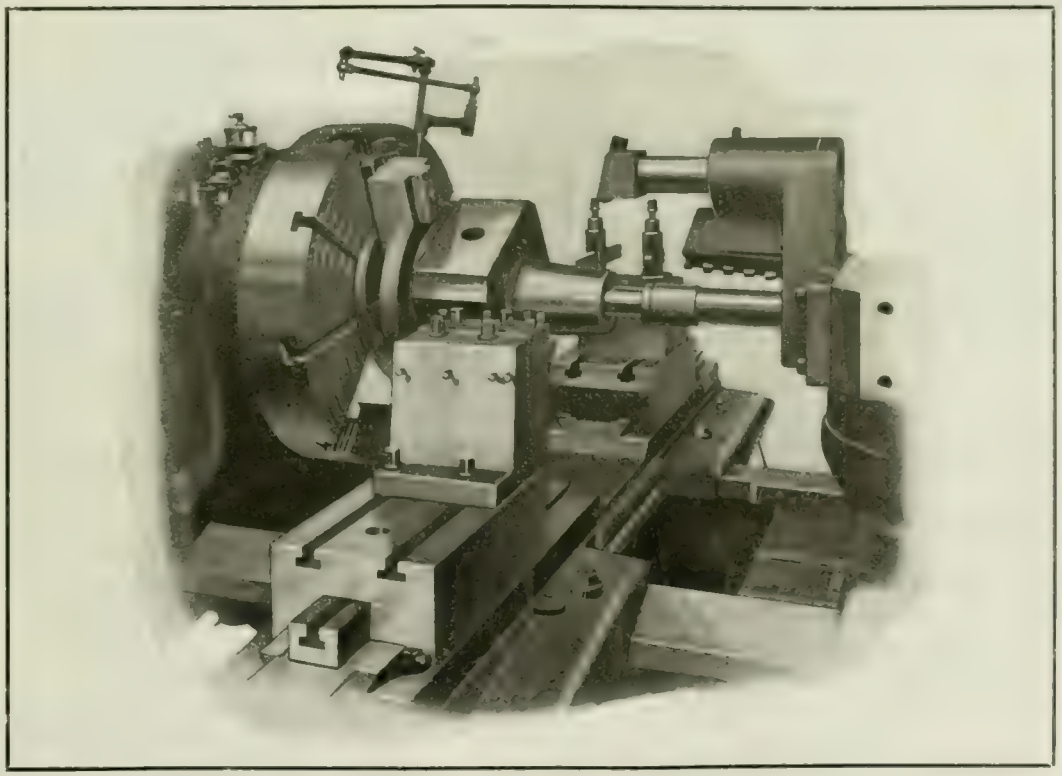

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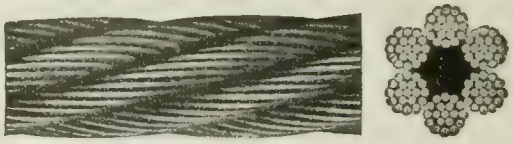

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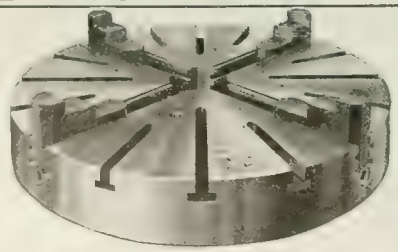

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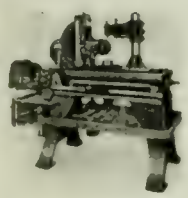

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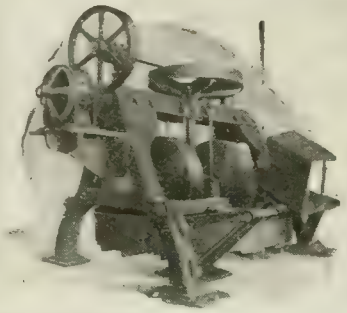

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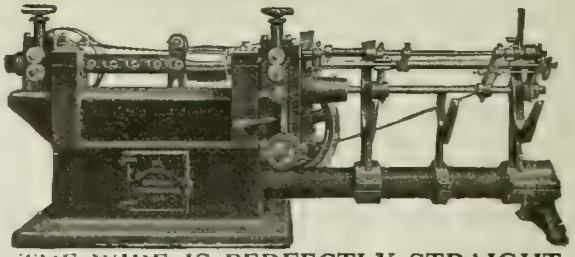

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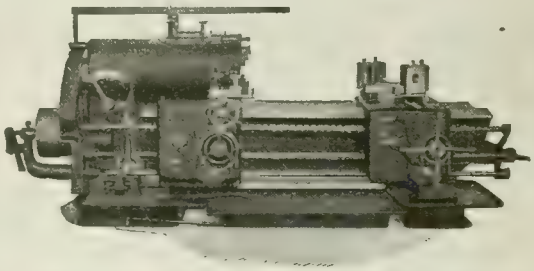

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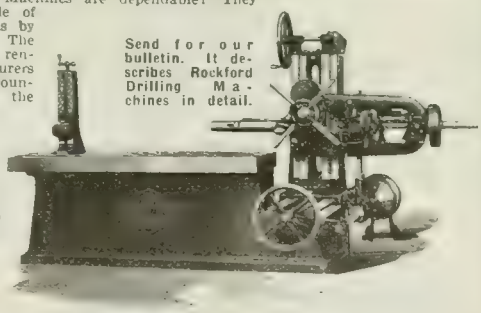

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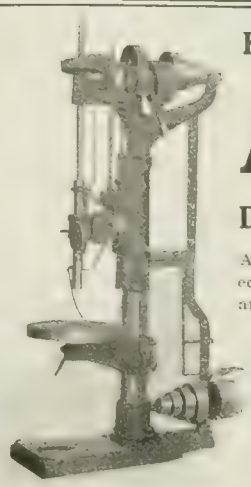

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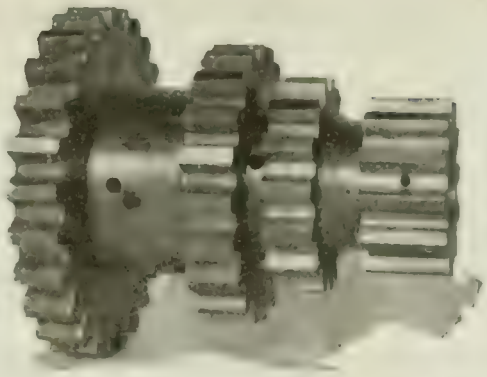

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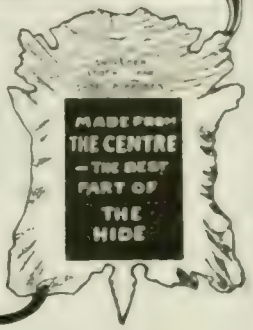

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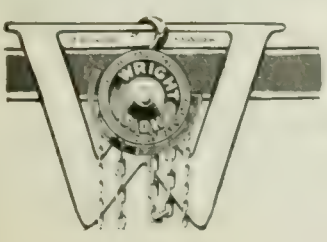

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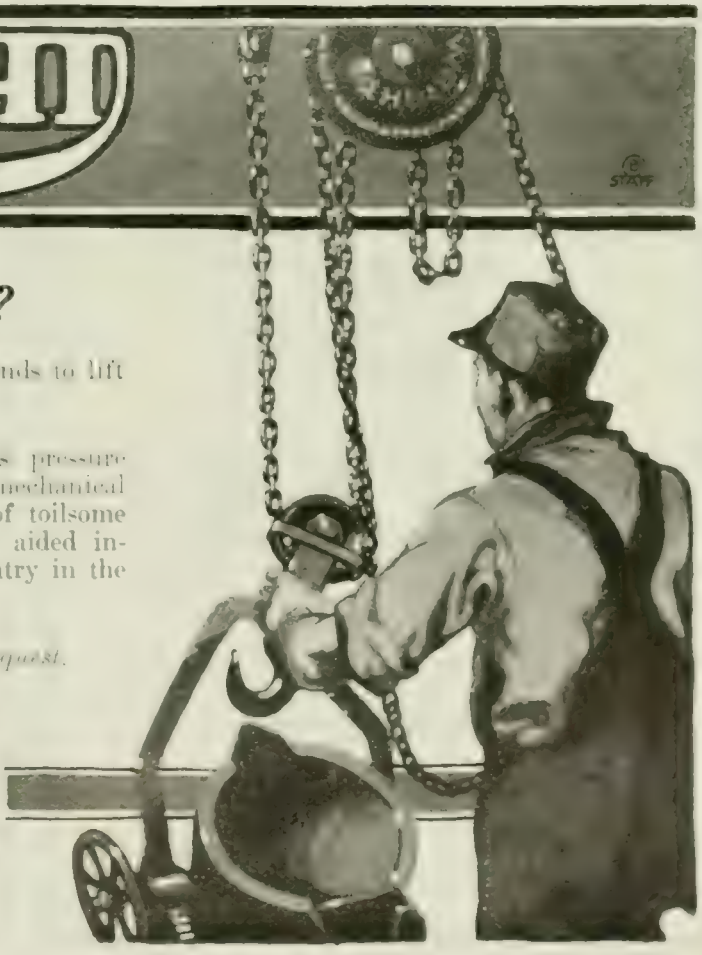

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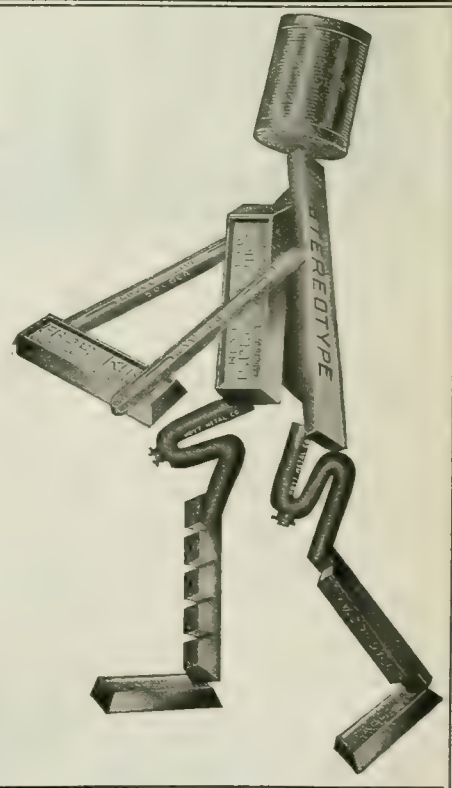

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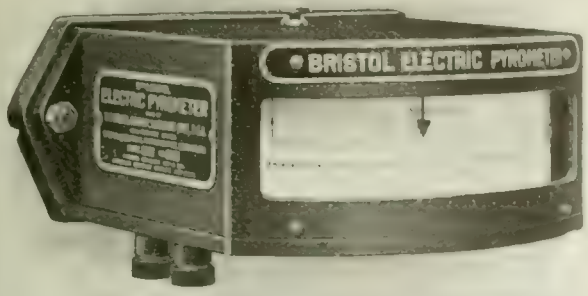

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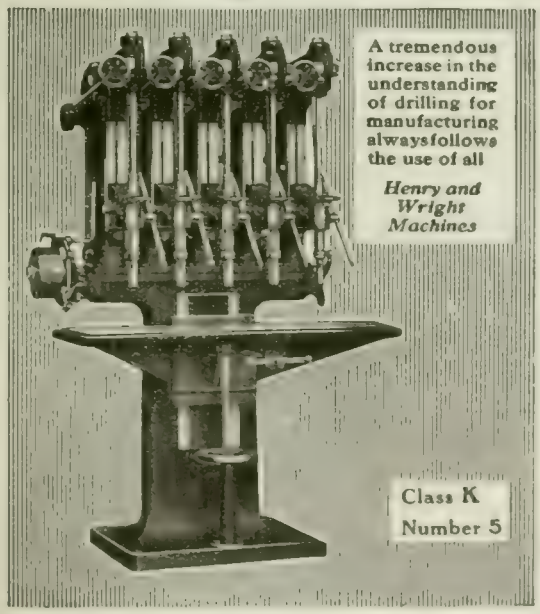

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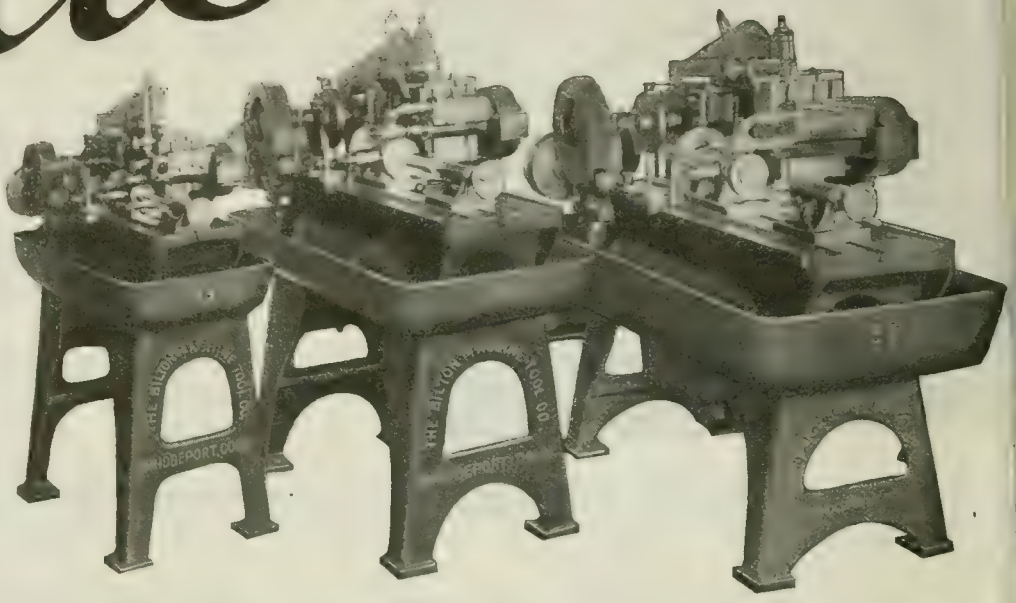

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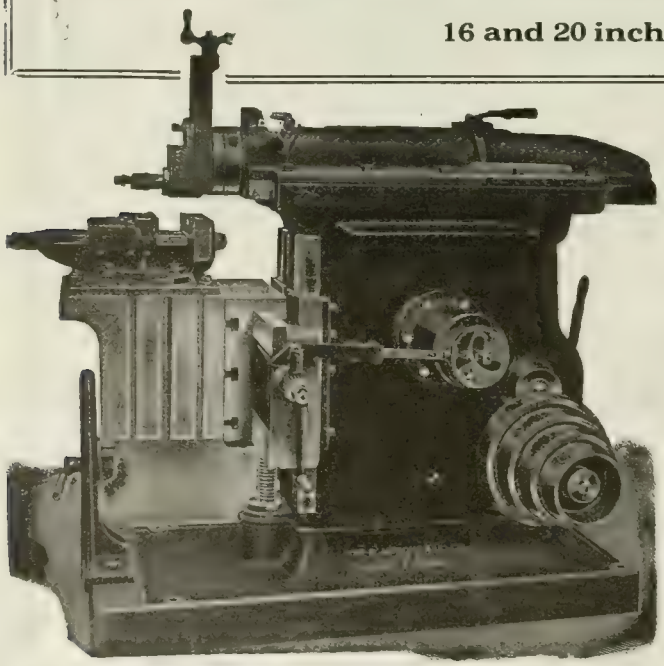

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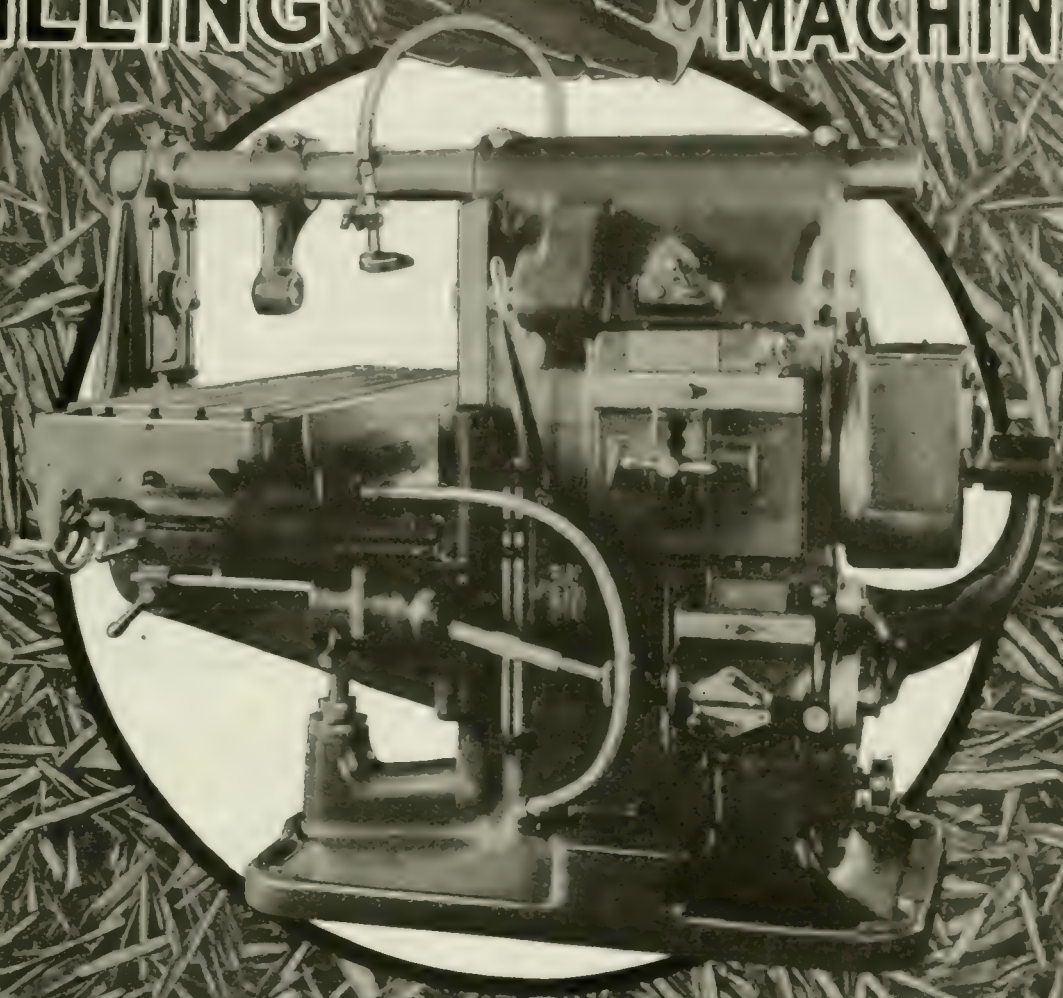

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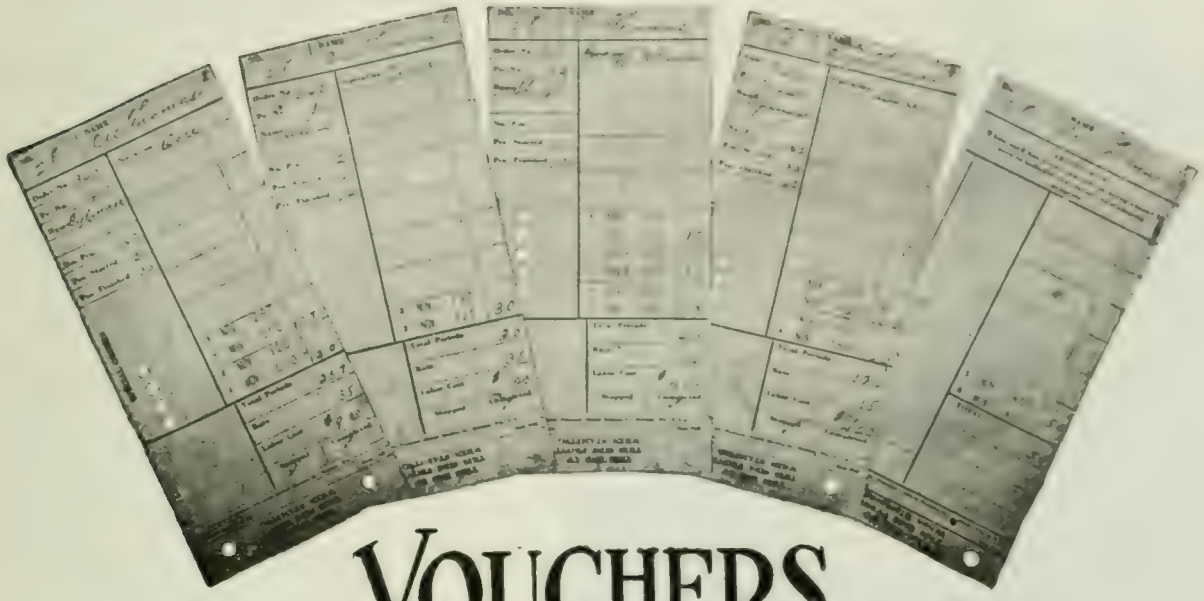

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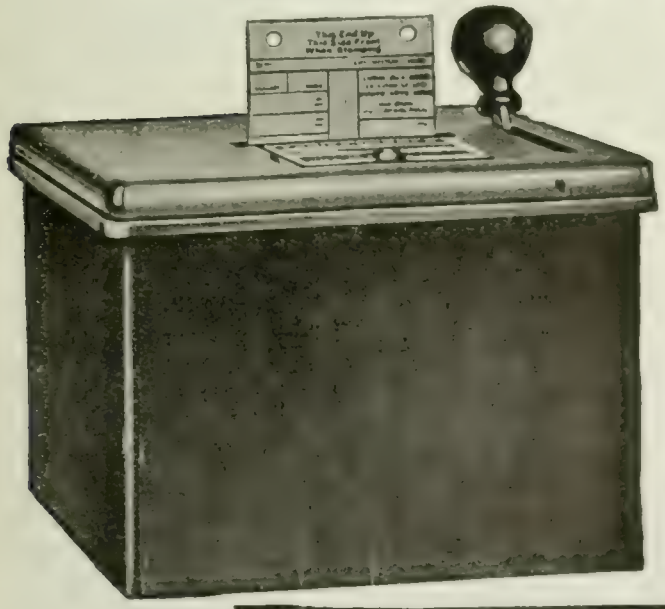

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXV. No. 13. March 31, 1921.

Efficient Fixtures used in Gear Cutting

Holding Gear Blanks—Methods of testing truth of arbor and work—arbors and faceplates—holding gears with shanks—holding internal gears, also varied work.

By Douglas T. Hamilton

FIG. 1. TESTING SQUARENESS OF SIDES WITH HOLE GEAR BLANKS CLAMPED IN PLACE

IN deciding on the best method of holding any particular piece of work when cutting gear teeth, there are certain necessary factors which must be considered. In the following we will enumerate a few of them:—the work must be so held that the teeth will be cut concentric with the hole in, or the shank on the gear. Slender gear blanks or those having thin walls, which are liable to spring out of shape should be very carefully clamped to hold them accurately. Internal gears should be held in some type of fixture, which will not distort the gear, and will hold it concentric while the teeth are being cut. A large number of gear blanks should not be held on an arbor at one time, unless the sides are absolutely square with the holes—this point will be dealt with more fully later. The work-arbor should run absolutely true, as is also true of face-plates against which the work is clamped.

Holding Gear Blanks

Bearing these points in mind, we will now explain how work can be accurately and satisfactorily held on the Fellows gear shaper, but before doing so it might be advisable to explain briefly the principle of this machine, and its peculiar features relative to the holding and cutting of gears.

Fig. 1 shows a section through the work-spindle of the Fellows gear shaper, and illustrates the construction

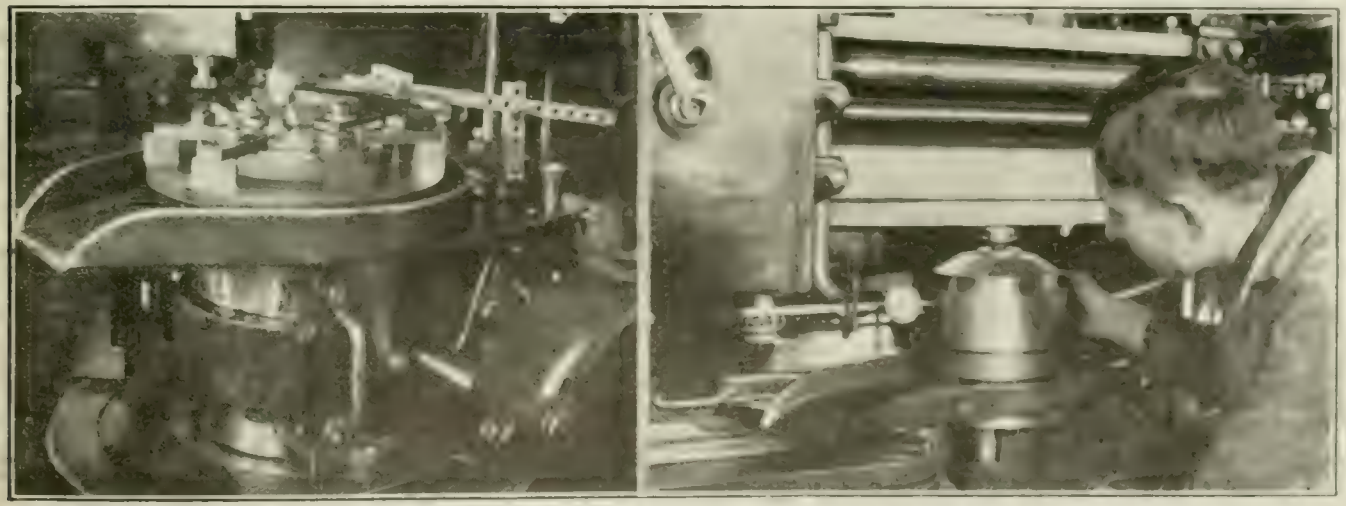


FIG. 11. SHOWING UNIVERSAL APPLICATION OF A [illegible] PLATE TYPE OF FIXTURE ON THE GEAR SHAPER

[illegible] TESTING TRUTH OF EXTERNAL SURFACE OF GEAR BLANKS WITH HOLE

of this spindle, as well as the type of standard work-arbor used. It will be noticed in this case that the spindle has a removable inserted tapered sleeve in which the standard work-arbor fits. This standard work-arbor differs from most work-arbors used in gear cutting machines, in that it has a reverse taper and the tighter the work is clamped to the face of the work-spindle, the tighter this work-arbor is held in the sleeve, so that all members, arbor, work, etc., are bound together as a solid unit. The work can therefore be cut either on the "push" or "pull" stroke of the cutter, the "pull" stroke generally being recommended for ordinary gear blanks, because the work-support, as shown in Fig. 1, can be brought into play to prevent any distortion of the work-arbor, while the teeth are being cut.

Methods of Testing Truth of Arbor and Work

There are certain preliminary operations which must be carefully handled prior to the cutting of a gear on the gear shaper. The first and most important one is to see that the arbor and work-spindle sleeve are perfectly clean. Then the work-arbor should be inserted in the sleeve from the botom, and tested for truth by means of a dial test indicator, as illustrated in Fig. 2. If the arbor is found to be out of truth, it is possible that a slight amount of dirt has collected in the work-spindle sleeve. The arbor should be removed, and the arbor and the sleeve carefully cleaned.

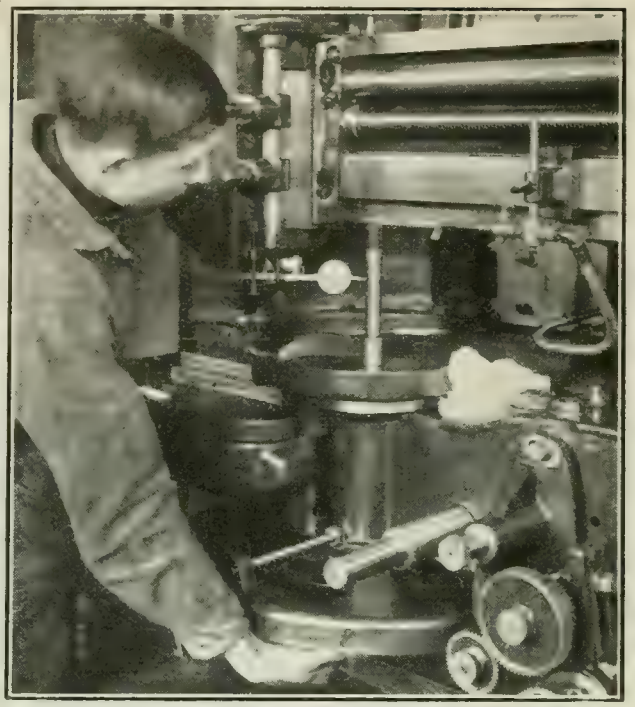


FIG. 2 –TESTING TRUTH OF WORK-ARBOR WITH A DIAL INDICATOR.

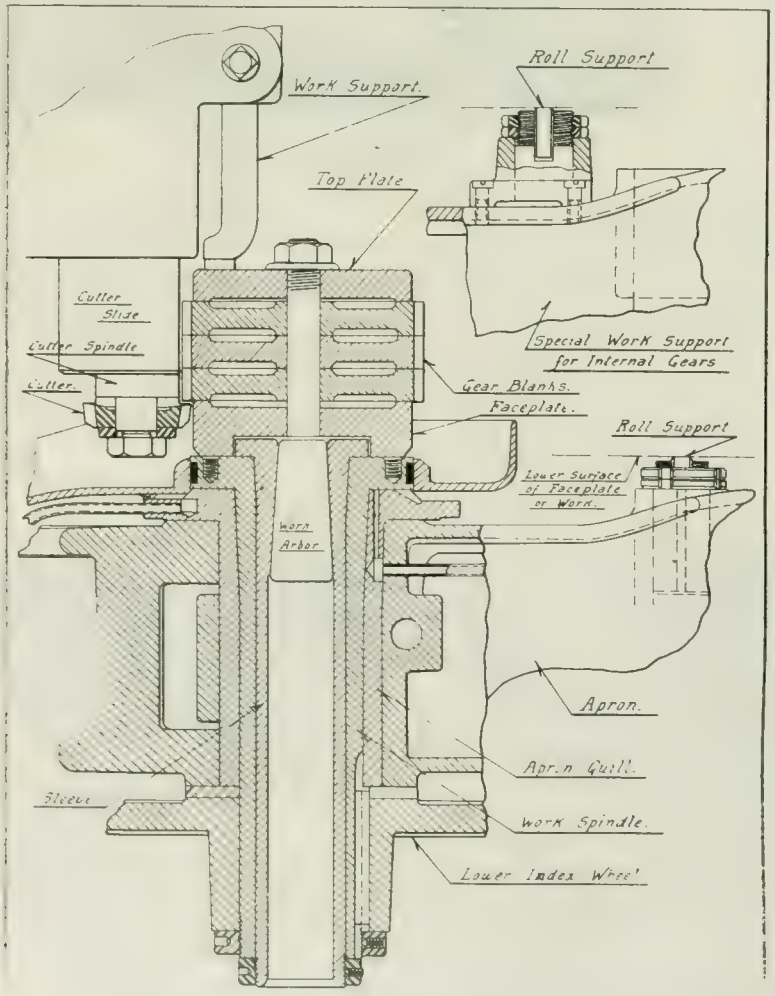


FIG. 1—SECTION THROUGH GEAR SHAPER WORK-SPINDLE AND APRON SHOWING REVERSE TAPER WORK-ARBOR AND METHOD OF HOLDING AND CLAMPING GEAR BLANKS.

The next step is to test the gear blanks themselves. If the work-arbor has been found to run true, the gear blanks, as shown in Fig. 3, are placed on the work-arbor and the nut left untightened. The dial test indicator is now brought in contact with the circumference of the work, and the work rotated on the work-arbor to determine if the holes in the gear blanks are concentric with the external circumference. If the gear blanks are found to be concentric, the nut is tightened and the test shown in Fig. 4 is then made. This consists in testing the gear blanks for truth of the holes with the sides. If the sides of the gear blanks have not been squared with the holes, the gear blanks will distort the arbor out of its true vertical plane, and if after the test in Fig. 4, the work is found to run out more than in test Fig. 3, it is a clear indication that the sides have not been faced square with the holes. If this difference in eccentricity exceeds the manufacturing tolerances on the work, the gear blanks should be removed and refaced; otherwise, the teeth will not be cut concentric with the holes in the gear blanks.

Arbors and Faceplates

Under no condition should a soft work-arbor be used. The arbor should either be made from machinery steel pack-hardened and ground, or from tool steel hardened and ground. A good pack-hardened machinery steel arbor is satisfactory. If the bushings are used, care should be taken to see that they are true, and it is preferable to grind them. They need not be hardened unless there is a large number of gears to

cut. All washers or faceplates used for supporting gear blanks should be kept true and faced off evenly either on a grinding machine or on a lathe, to insure that the faces are square with the holes. Gear blanks that have been found to be inaccurately machined should be corrected before the teeth are cut. This is especially necessary if it is found that the faces of the rims are not true with the holes.

Experience has shown that money spent for first-class equipment for holding gear blanks, and for keeping them to a high standard is money well spent. If the work is handled under the right conditions, elaborate inspection of gear blanks after cutting is not necessary.

Methods of Holding Various Forms of Gear Blanks

Some of the principles previously explained in connection with the holding of gear blanks will be further illustrated by means of examples. Fig. 1 shows how an ordinary plain gear blank, either with or without arms, can be satisfactorily held. The work should rest on a faceplate, and have a faceplate on top of it, so that the members can be clamped together and the work-supports used.

Fig. 5 shows how a small pinion is held. In this particular case, the faceplate is dispensed with, the work-arbor itself acting as one. The arbor is held up in the sleeve by a nut because the shape of the work necessitates operating the cutter on the "push" stroke. The thrust, therefore, comes on this nut located on top of the work-spindle. As the work has a tapered hole, a washer is used. This practice is better than using a tapered arbor, as the bushing is much easier and cheaper to make, and can be easily renewed. This is a very simple but effective fixture.

Fig. 6 shows how a two-step gear is held. It will be noticed here at A that the lower face-plate is recessed to clear the hub on the gear blank, and supports the latter close to the rim. The clamping plate is also recessed to clear the other end of the gear blank.

This is a comparatively simple fixture and if accurately machined will produce exceptionally good work. The hole in this gear blank is square, necessitating the use of a bushing on the work-arbor. For cutting the small gear, the fixture shown at B is used, and consists simply of two plain washers. The gear blank rests on a washer located on top of the sleeve in the work spindle and is clamped in place by a top washer and nut. Owing to the shape of the work, a cutter spindle extension and thin-web cutter are necessary.

Holding Gears Having Shanks

One principle that should be adhered to in the holding of gear blanks is that as far as possible they should be located from the same points that are used when the member is assembled in the finished product. Holding work on centers should be dispensed with, because seldom if ever is the work held on centers when in actual use. The work should be supported in exactly the same manner as when in actual use; and this, of course, with accurate fixtures, eliminates the possibility of eccentricity, which is one of the chief causes of noisy gears.

Fig. 7 shows an interesting type of fixture for holding a pinion having a bearing on both ends. It will be noticed here that the work-arbor is of special shape, and is used to center a floating fixture, this floating fixture being clamped directly to the top face of the work-spindle. At the upper end, the work is supported by a special supporting arm. This is held on the apron of the machine, and surrounds the work-spindle taking the place of the regular chip-pan. It comprises a main fixture and two locating studs, one at the rear end of the arm and the other in the centre. The latter is provided at its lower end with rack teeth so that the supporting arm can be elevated to remove the work. This arrangement provides a very accurate and efficient means of holding small pinions which have a shank on both ends.

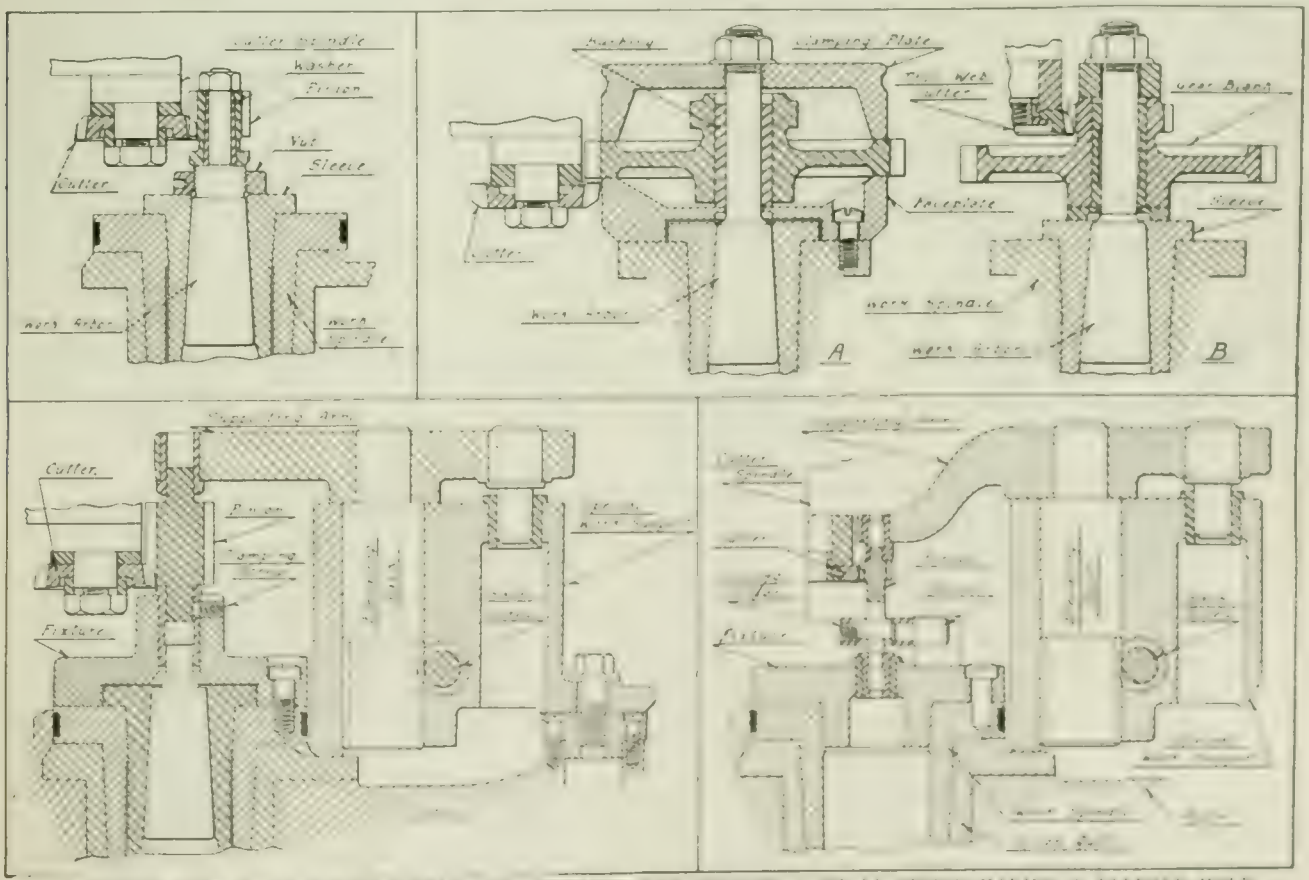


FIG. 5 UPPER LEFT HAND SHOWS SIMPLE ARRANGEMENT FOR HOLDING A SMALL PINION HAVING A TAPERED HOLE.
FIG. 6 UPPER RIGHT HAND SHOWS METHOD OF HOLDING A TWO-STEP GEAR FOR CUTTING TEETH ON SMALL AND LARGE STEPS.
FIG. 7 LOWER LEFT, ILLUSTRATES A SPECIAL FIXTURE FOR HOLDING A PINION HAVING A SHANK ON BOTH ENDS.
FIG. 8 LOWER RIGHT SHOWS A SOMEWHAT SIMILAR FIXTURE TO FIG. 7 WITH THE EXCEPTION THAT THE PINION IS SMALLER AND THE WORK IS DRIVEN IN A DIFFERENT MANNER.

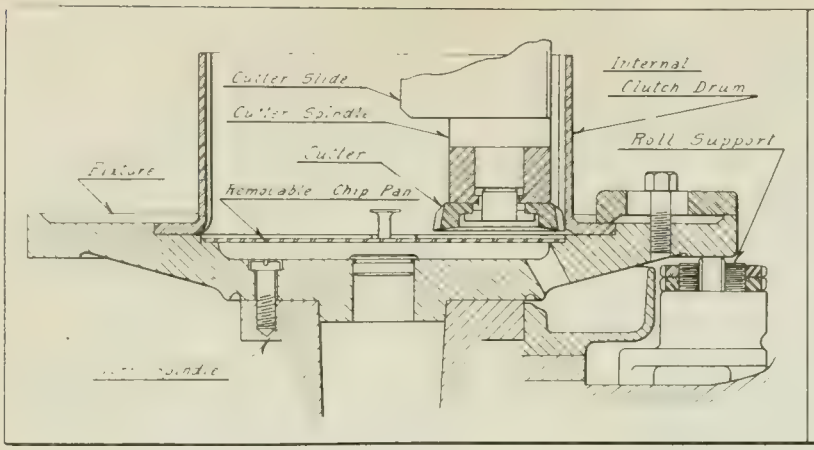


FIG. 9—CUTTING AN INTERNAL GEAR CLUTCH HOUSING.

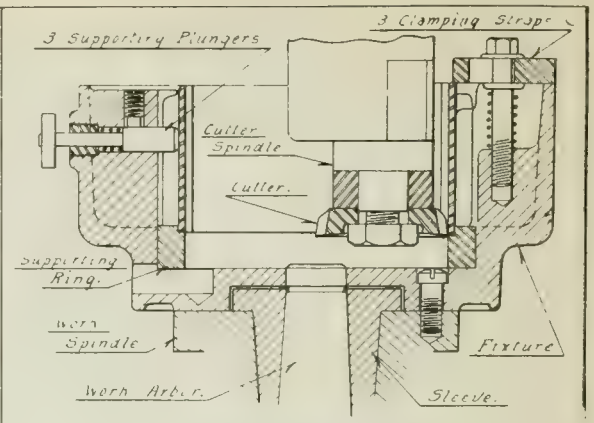


FIG. 10—A POT-TYPE FIXTURE FOR CUTTING A THIN-WALL INTERNAL GEAR.

A slightly different arrangement is shown in Fig 8, where the pinion is much smaller. In this particular case, a floating fixture is used, and the work-arbor is dispensed with. In setting up, the work is clamped, and then trued up by means of an indicator, after which the fixture is clamped in position. At the upper end, the work is supported by an arm held on a fixture similar to that shown in Fig. 7, but owing to the shortness of the work, a special over-arm support is necessary. In this particular case the work is driven by a dog which is clamped to the work itself and fits into a slot cut in a projection on the fixture.

Holding Internal Gears

Internal gears in many cases present difficult holding propositions, and especially when the internal gear has a considerably long face and a comparatively thin wall, such as is the case with clutch housings and similar work. If the clutch housing shell is heavy enough, then a fixture of the type shown in Fig. 9 can be used with satisfaction. This is a very simple fixture and is easily made. It comprises a faceplate, which is centered by the work-spindle itself, and is also clamped to it. The roll support on the apron, which is a standard appliance on the gear shaper, provides additional support for the fixture. A seat on the fixture is machined to fit the work, and the latter is held in place by means of three clamping straps. The work, aside from this support at the bottom, is not supported against the deflecting action of the cutter. The gear shaper, owing to the fact that the forward face of the cutter is provided with a clearance angle, exerts very little outward thrust, so that in this particular case, further support for the work is unnecessary.

An internal gear having a thinner wall is illustrated in Fig. 10. Here the wall of the gear is too thin to resist the outward thrust of the cutter, and therefore, a pot-type of fixture is necessary. This carries four spring plungers, which are locked after the work is clamped; thus serving to resist the thrust of the cutter against the work. Three clamping straps operating against the top face of the work are used to hold the work against the hardened steel ring in the fixture itself. This fixture differs from the other in that it is centered by the work arbor instead of the work-spindle; but it is clamped to the work-spindle in a similar manner.

A Universal Fixture

An exclusive advantage of the gear shaper method is shown in Fig. 11. Owing to the arrangement of the work-spindle which is carried on an apron that can be swung clear from the machine, the work can be clamped and held on a faceplate in a similar manner to a lathe. It can also be trued up accurately by means of a dial test indicator. This is illustrated very clearly in Fig. 11, which shows the cutting of an internal gear on the gear shaper without the use of a fixture, except an ordinary faceplate and locating ring, for centering work, the work being held by clamping straps as illustrated. This method of holding work is of great advantage in a jobbing shop.

Pipe Capacity—Relative Sizes of Opening Areas

In heating and ventilation, water or air distribution it is often necessary for feeders to be taken from the main header, or vice versa. The combined cross sectional areas of the branches should equal that of the main line. Areas of circles vary as the squares of their diameters.

1—Three equal branches leading from one main. 2—Two feeders in ratio of 3:2 leading from main. 3—Two elongated sections leading from round main. Suppose main pipe D in cases 1 and 2 to be 15 ins. diameter. Area of large opening equals 15 inches squared x .7854″ = 176.715 sq. in.

1—Area of one small pipe equals 176.715 ÷ 3 = 58.905 sq. in.

Diameter (d) equals 8.66 inches.

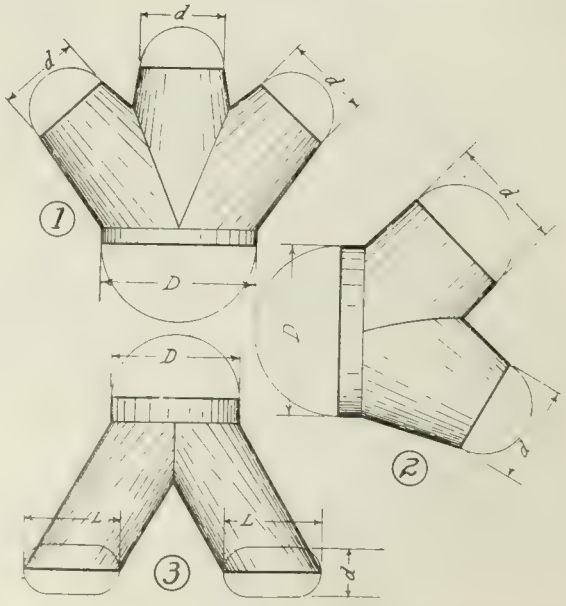
2—Ratio of branches 3 : 2.

$$\text{Area of large branch} = \frac{3}{5} \text{ of } 176.715'' = 106.03 \text{ sq. in.}$$

$$\text{Dia. of large branch} = \sqrt{\left(\frac{A}{.7854}\right)} = 11.62 \text{ inches.}$$

$$\text{Area of small branch} = \frac{2}{5} \text{ of } 176.715'' = 70.68 \text{ sq. in.}$$

$$\text{Dia. of small branch} = \sqrt{\left(\frac{A}{.7854}\right)} = 9.48 \text{ inches.}$$



Canadian Machinery.

It's Often the Simple Idea that Saves the Time

A Milling Problem—A Planer Kink—A Simple Calculation—A Portable Polisher, Two Punch Press Ideas, and a Simple Yet Effective Fixture.

By DONALD A. HAMPSON, Member A.S.M.E.

A DIFFICULT milling job is depicted at Fig. 1. We had to cut out the notches A-A on the pieces shown to the left of this view, and the parts were of drawn steel, ¼ inch thick, and having a section about ¾ inch wide left between the notches. To turn them out in manufacturing time, forty-eight were placed in a holder, this in turn clamped in a milling fixture, and the work passed between two straddle mills. The operator burred the work and loaded a spare holder while the machine was running.

The machine was in first-class condition, the fixtures well made, but we could not get the pieces to measure closer than 0.002 inch and this was too much off to pass—the particular measurement being from the bottom to the notch. A part of this variation was due to inaccuracy in the steel but most of it came from the work being unevenly clamped. We used a bar of steel like the one in Fig. 1 for a clamp over the work. We tried these clamps thick and stiff, and we tried them thinner, with an additional screw in the centre—but the work varied just the same.

Not until we adopted the scheme illustrated did we have success. A dovetail slot was planed the full length on the under side, and in this slot was driven a filler of maple cut across the grain. When wedged full, the clamp was put on the planer and the wood surface machined off true with the back and straight. This insert seemed to have the necessary qualities, for the accuracy, after its use, was all that could be desired.

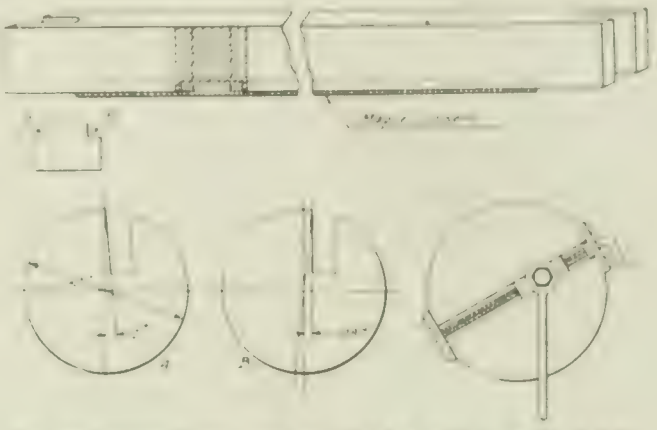


FIG. 1. UPPER VIEW. FIG. 2. LOWER RIGHT HAND VIEW. FIG. 3. LOWER LEFT HAND VIEW.

A Planer Kink

Many old planers have the feed driven by a rod set in the flange on the stub end of a half-turn shaft. Means of adjusting the amount of feed are provided by the slot in the flange, along which the rod may be set by shifting the bolt.

The time lost in setting this bolt, getting it too far or not far enough, and in guessing at the proper place, then leaving it at the wrong one because it is an effort to change—that lost time would pay for the alteration shown at Fig. 2 in the first month. Flat plates are screwed across the ends of the slots, a screw is turned up and one end bent to the form of a crank, and a nut is made to slide in the T slot. This change makes feed shifting as easy as on any modern tool. Adjusting can be done while the machine is running and the various increments of feed secured both positively and quickly.

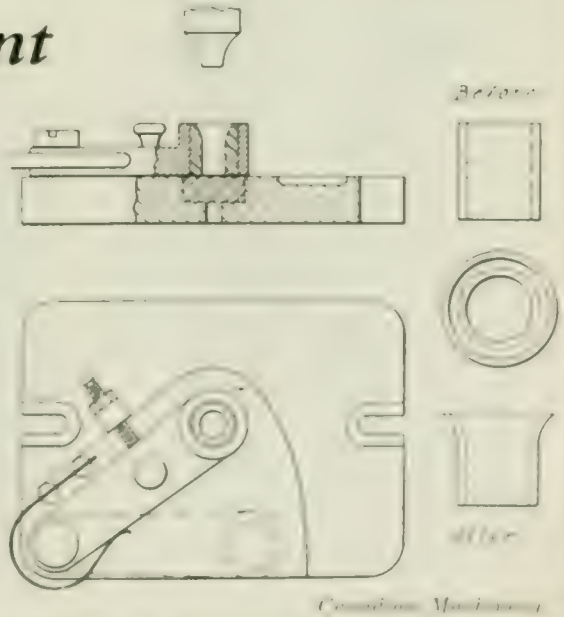
Another Story

Some cutter blanks were sent in from a nearby shop to have the slots milled, these to be milled so that the cutting edge of the tool should lie at an angle of 5 degrees with the diameter, as shown at Fig. 3-A. The machinist to whom the job was given laid out the angle on the end of one piece and set

Punch Press Attachment

The drawing herewith illustrates a safety device fitted to a die for the protection of the operator when placing the work in position. The operation is the flaring of the small tube as shown. The tubes are first cut off in the automatic from three-quarter inch by one-half inch steel, and then bell mouthed in the punch press. Instead of the operator placing them against the guide and holding with his fingers, we arranged the swinging arm shown. This arm consists of a piece of steel pivoted at the left hand end, and with a bell mouthed container at the other. A tension spring kept the arm against an adjustable stop, which aligned the work beneath the punch. The operator pulled the arm back as the ram ascended and his hands were never in the danger zone.

By D. A. Hampson



up the piece on centres, intending to line it up with a square from the table top. Its position then would be as shown at B. He found, however, that he could not reach his scribed line when set up. He next asked for help to determine the distance between the arrows in the figure, as his idea was to set the side of his cutter to an arbor on the centres, then move with the aid of the dials.

Actually, he could have made the calculation himself, but it was easier to ask than to think it out, so, like many others, he lost a chance to apply a bit of his education to everyday work. The desired distance, the side of the cut, and the diameter, form the three sides of a triangle in which the unknown distance in the "side opposite" and half the diameter is the "hypotenuse." This, when the angle is known, forms one of the simplest of trigonomic equations. The sine of the angle is .087. The equation is SO = Hyp. x sin., which in this case may be solved mentally 1 x .087 = 0.087 inch. This is the distance off centre when the line of cut is placed vertically.

A Simple Idea

One of the workmen from the foundry appeared in the shop unexpectedly with a miniature electric motor, a discarded brush that his foreman had given him and a drawing. He said he had been studying on an idea and would like to get a little machine work done for himself at the usual shop rates. It was a shop policy to encourage any of the men who would think along mechanical lines and this fellow's job was put through the same day. The idea was that of an electrical stove polisher, in fact a scheme to lighten the housewife's labor, and while doing so to shine the stove without the use of polish, adding another to the long list of devices that have revolutionized our homes in the past decade or two.

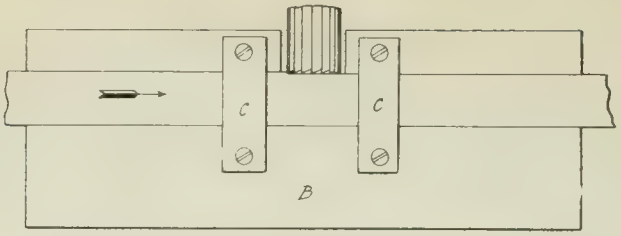


FIG. 5—FIXTURE FOR REDUCING EDGE OF BARS.

Fig. 4 shows that the device is very similar to the light portable grinders, extensions of the motor shaft carrying the "abrasive wheel" and the two handles. In this case, a section of a wire brush worn down to five inches in diameter formed the working tool. This was brought in contact with the top of the stove and there moved about at will. No preparation was used. Our man's theory was that cast iron has in its composition practically the same elements that form the basis of stove polishes. The results he got were proof that he was right. His revolving brush removes the rust and dirt from the surface and further metal-to-metal contact burnishes the iron, which supplies its own graphite polish, so to speak.

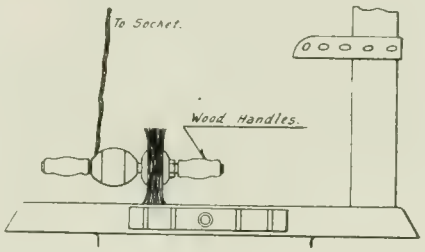


FIG. 4—SHOWING STYLE OF STOVE POLISHER.

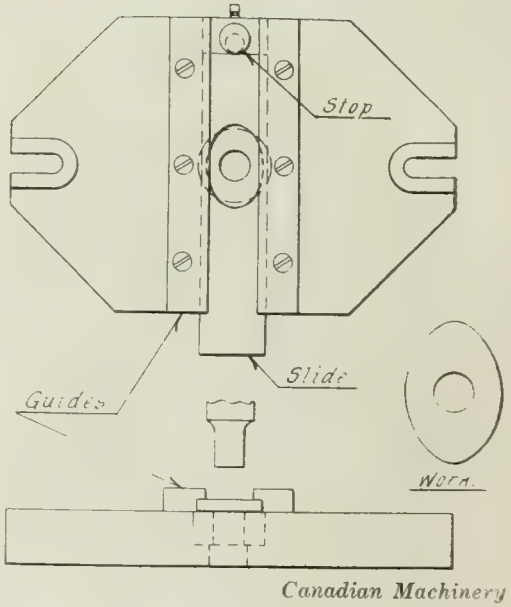
A certain shop manufactures nearly a million pieces per year from rectangular cold drawn steel bars. Various kinds of vises hold the bars, which are placed a number at a time in milling machines, and cut off. Frequently it is possible to do some forming along with the cutting off. Ordinarily, the shop's stock of steel includes all the sizes needed, but conditions such as have existed during recent years and the "specials" that have to be made for large buyers sometimes require steel of a size that is not obtainable. The only way to get it is to cut down the next larger size.

Fig. 5 shows a fixture used for reducing the edge of bars a few thousandths. For instance, steel .873 inch x .183 inch would be in stock and this would be the nearest to make a thousand pieces .870 inch x .183 inch from. If there wasn't a fixture for cutting to this size, the cost of one of the type shown is a mere trifle. B is a piece of cast iron planed top and bottom with a tongue on the bottom to fit the miller table. When bolted to the table, a slot is milled, .184 inch deep and .870 inch wide. The left hand end is widened to .873 inch. The two straps C fasten over the slot to confine the bars. A new bar is pushed in at the left hand end, an end mill removes the excess at high speed and the bar passes out at the right hand end the required size.

Punch Press Feeding Device

We were always fortunate in the matter of punch press accidents and wanted to remain so. Safety devices applied to old and new tools are profitable expenditures. The oval piece here shown is of 1-16 inch brass. The operation is to punch the center hole. The die is set in the die block and the top is provided with two strips for guiding the slide which carries the work. When placing in the work the strip is pulled out, and then pushed in below the punch. When the hole is punched, the slide is pulled out far enough to allow the work to drop out into a box located below the press bed. In addition to this safety arrangement the press is provided with a guard, but as the hands of the operator never go near the punch, the guard is only an added protection.

By D. A. Hampson



Canadian Machinery

Typical Examples of Manufacturing Lathe Work

By J. H. Moore

THE modern machine tool of to-day is a very different tool from its prototype of ten years ago. Wonderful improvements have been made until we now have automatic millers, automatic screw machines, automatic lathes—but why go further; every up-to-date mechanic knows the rest off by heart.

There comes a time, however, when a problem arises that the automatic cannot economically solve. True, the automatic type of machine is ideal when large quantities are put through at a time, but how about the shop not quite big enough for that, where the work goes through in lots not large enough to justify the installation of special automatic machinery. Are they to be content with ordinary production, or can they obtain a higher rate of production without quite so much expenditure?

That question is easily solved by looking through the advertising pages of any modern technical journal. In such pages will be found all types of machines that are medium steps, so to speak, in increased production. These steps may, of course, lead to the point where increase of business calls for a still further expenditure in equipment, but let us leave the possibility at this point and consider the use of the manufacturing lathe as a productive measure.

There are, of course, numerous manufacturing lathes of various designs on the market, each claiming some particular feature or features. We will, however, not attempt to even touch upon these points, but rather let this article be a lesson on a few examples of the possibilities of such a machine tool. Through the courtesy of the Lodge and Shipley Co., Cincinnati, Ohio, we are able to show in photographic form some work completed on their particular type of manufacturing lathe.

The main idea embodied in the design of such machines is this: to retain the simplicity of the general purpose engine lathe, at the same time adding attachments which will make the machine accomplish repetition work. For example, multiple positive diameter stops, automatic length feed stops, special tool blocks, and so on.

Take the use of the stops. In the first case the diameter stops allow repetition work of certain sizes, while the length stops guarantee that the feed trips at the same point in each case. The value of special and multiple tool blocks is readily understood, for by their use it is possible to group the cutting tools for productive purposes.

Without going into the design of such machines let us consider a few examples of work performed. At Fig. 1 is shown the machinery of a shaft such as could be found in almost any manufacturing plant. The piece shown is the main driving shaft for a selective headstock, and the operation-times given include handling, setting up, etc. This piece was machined to demonstrate the difference in machining time possible, and for the sake of comparison ten pieces were machined under three conditions. The diameter and length stops were both used at the first test, and the time for the ten pieces was 1 hour 56 minutes or an average of 12 minutes each.

In the second test the diameter stops only were used, and in this case 3 hours 4 minutes or 18 minutes each was necessary to complete the ten pieces.

The third and last test was accomplished without the use of either the length or diameter stops, and 4 hours and 3 minutes was necessary to complete the ten pieces. This meant that the average time for each piece was 24 minutes. It would be well to add that the work was accomplished on the same lathe by the same operator, under the same conditions, the test being held to demonstrate the efficiency of the stops. From a glance at the time figures it will be seen that production increased 100 per cent.

Another Example

Fig. 2 shows a rather interesting piece which, if it was to be made in sufficient quantities would no doubt be produced on an automatic screw machine, or some such production tool. However, in this case the lots were limited, so that it was made on a manufacturing lathe. The work is known as the turning of selective head main driving shaft beading nuts, and the work is done at one setting from large bar stock, leaving the bar stock in the centre intact. This was accomplished on an 18" machine, and the tool set up consisted of an L-tool, threading tool, cut-off tool, and finishing tool, in a four-way tool block. A facing tool was also held in a high duty tool block.

The operations consisted of the following steps. The stock was first turned on the outside with the finishing tool, after which the outside of stock was threaded with the threading tool. Next came the cutting under ring with the

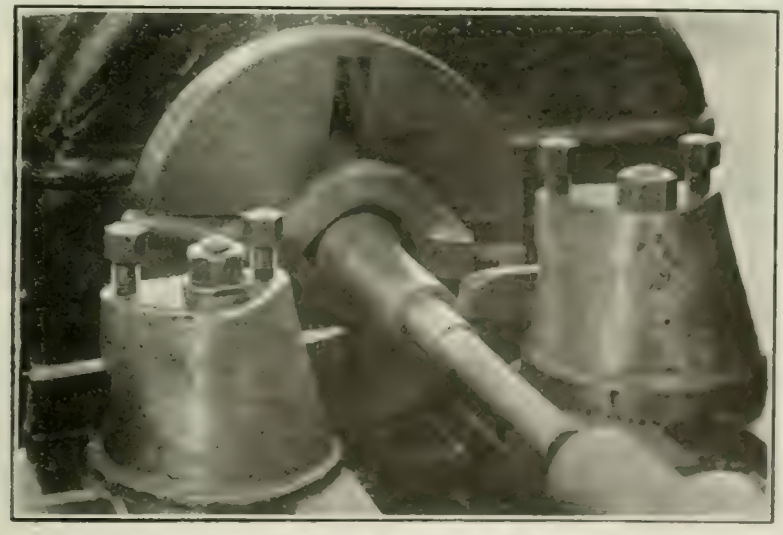


FIG. 1. A GOOD EXAMPLE OF SHAFT TURNING.

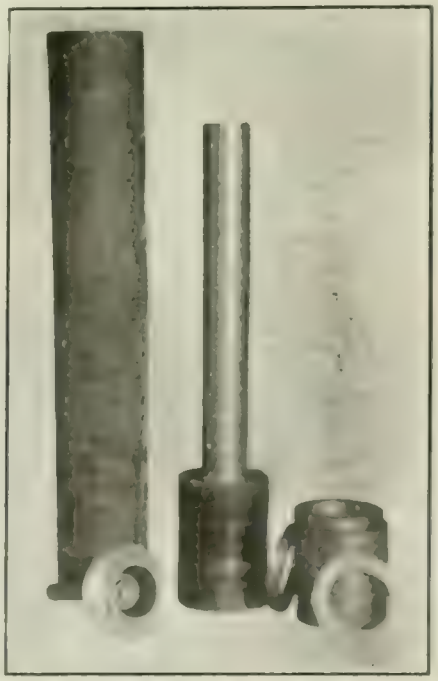


FIG. 2. SHOWING THE ROUGH STOCK AND FINISHED PIECES.

L-tool, leaving the bar stock in the centre intact.

The fourth step consisted in facing off the end of ring with the tool in the rear rest. In the fifth step, the cut-off tool in the four-way tool block, and the facing tool on the rear rest are set so that when the fourth step is finished the cut-off tool when run forward will cut off the ring to its proper thickness.

The sixth step consists of running in the cut off ⅛", revolving the swing threading tool into position, and the chamfering of both outer edges of the ring. The next and last step consists of finishing with the cutting-off tool. It will be noted that the photograph shows the testing plug, samples of the work, and both the rough stock, and the appearance of same after the nuts have been made.

Fig. 3 illustrates a close-up view of the L-tool cutting under ring, while Fig. 4 illustrates the turning of rings in the third operation.

Two Other Examples

Fig. 5 depicts a rather interesting job being performed. The work is that of turning a double bevel gear, and the value of multiple tooling is very evident in this view. In the first operation a four-way tool block is used on the front rest, while the gang tool block shown is used in the second operation, viz., the machining of the beveled surfaces.

There are many other examples that we could illustrate, but enough has been shown to point out the advantage of studying your work intelligently, and securing as efficient a tool as your business will permit. We are all after lower production costs, and a good way to obtain the same is to study your present methods of production, then see if you can make an improvement on the same. Suppose you are putting through certain kinds of work in lots of 5 or 10. Think carefully. Is it not possible to put them through in lots of 10 or 20? If you can conveniently do so, try this method, use the proper equipment, then watch your production costs go down.

HOW FAR WILL A PUMP DRAW WATER?

This is a question often asked in reference to ordinary pumps used for raising water to just over ground level, and as a rough guide it may be taken that the maximum distance in feet would be equal to the number of inches at which a mercurial barometer is standing, although in practice this depth would usually be impossible, as leakages and friction have to be considered. Usually, says Practical Engineer, a simple pump will, if it is absolutely tight and sound from the piston or bucket to the water level, raise water slowly from a depth of about 30 feet below the bottom valve, but more usually 28 feet would be the limit of effective working, although few pumps can be depended on for more than a 25-foot draw owing to faults in their fitting. Even a pinhole will destroy the vacuum under the lower valve in a very short time or a few grains of sand in the valve, and preventing it closing tightly, will have the same effect, this very often being the cause of pumps "losing water" when drawing from a sandy source. As to how high a pump will lift water above itself, the limits may be defined by the power available to lift the weight and the strength of the appliances used in the putting the necessary power into effective action. Horizontally, water can be moved for practically any distance, taking friction into consideration, as this is considerable. Pumps with more than 25 feet effective suction will rarely be found satisfactory for any length of time.

RUSTPROOF PROCESS

Rust. Who hasn't heard of the word, far less experienced the trouble of trying to remove it from exposed or neglected material. But now comes a process that is said to overcome the trouble entirely.

The Andrews rustproofing process, with premises at the Andrews Rust Proofing Laboratories, 821 Book Bldg., Detroit, Mich., is said to be exhibiting satisfactory results in this line, and following is description of the process as given out.

The pieces to be rustproofed are placed in a furnace which burns a mixture of gas and air. It is claimed that after the work has reached the uniform heat of the furnace, an atmosphere is created that forms an oxide which penetrates the most minute pores of the metal. The work is then removed from the furnace and immersed in a bath of oil, heated to a temperature of 100 degrees Fahr. The oil carbonizes and, mixing with the oxide, forms a paste which sinks into the pores. At the same time, quenching in the oil contracts the pores and seals up the deposit therein. While the temperature of the furnace is not given, it is stated that it is not high enough to distort or in any way injure the work.

Among the claims made for the process are: That parts treated by it have a fine ebony finish and that they have withstood a test by being sprayed with salt water in a closed vessel for 83 hours and remaining suspended over the salt solution for an additional 157 hours without being rusted.

INSPECTION OF HOISTING CHAINS

Few details in industrial life cause more accidents to men and machinery than that associated with the handling of heavy material. Too often this work is carried on with little or no attention to the lifting appliances. A chain or rope is secured and placed on the work and it is expected that it will give the same service that it did the previous time. The imperative need of systematic inspection to hoisting appliances was again demonstrated in the fatal accident to a railroad employee in Charlottetown, P.E.I., recently. A locomotive tender was being hoisted from position and the workman was pulling out some blocks from underneath when the hoisting chain broke, the tender falling and crushing his arm. He died following amputation. The safety feature of industrial welfare is one of the factors where consistent co-operation between executive heads and the workmen is essential to mutual confidence and maximum efficiency.

FIG. 3—CLOSE UP OF "L" TOOL.

FIG. 4—TURNING OF RINGS.

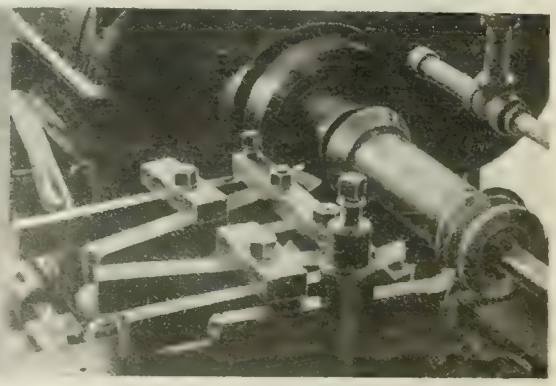


FIG. 5—TURNING A DOUBLE BEVEL GEAR.

Points to Consider in Cylindrical Grinding

Factors Which Determine Wheel-wearing Action—Laws Relating to Draw-in and Traversed Cuts—Production Costs.

By W. H. CHAPMAN

CYLINDRICAL grinding is a subject in which we are all vitally interested. This paper, which was presented before the American Society of Mechanical Engineers, comprises a study of the laws involved, and an analysis of grinding action both for draw-in cuts and traversed cuts.

In view of the effect of wheel wear on grinding efficiency, formulas are derived for wheel wear in terms of known variables such as grain size of wheel, work speed, wheel speed, feed, etc. By calculating values for wheel wear for different conditions and comparing them with production figures calculated under the same conditions, a proper selection of wheels may be made.

The fact that the expense due to wheel wear comprises but a small item in the total cost of grinding, however, may lead to wrong conclusions if this is made the controlling factor. In the latter part of his paper, therefore, the author discusses the subject of production costs and the various factors that should be considered in securing the highest possible grinding efficiency. With this introduction, let the author speak for himself.

In Fig. 1 is shown a section of wheel and work with the elements greatly enlarged. The grain paths across the work are indicated and a shaded area indicates the shape of a single chip. The grain paths are shown as straight lines tangent to the feed circle. Actually these paths are not straight lines, but are epicycloidal curves. However, within the limits of probable dimensions which are actually involved in any cylindrical grinding operation, a graphical layout of the grain paths on a large scale (say ¼ in. = 0.0010 in.) will show that these curves are so nearly straight lines that the error is negligible. The mathematical relations are greatly simplified by this assumption. By actual trial it was found that there was seldom over 2 per cent. difference in the values of maximum chip depth obtained by the use of the actual and the assumed forms of grain path.

Wheel-Wearing Action

The three factors to be considered as determining wheel-wearing action are (1) the frequency with which the grain is applied, (2) the average grain depth of cut as indicated by the chip dimensions, and (3) the kinetic energy of the grain due to its mass and velocity.

[In his complete paper, the author here discusses the three factors mentioned and derives the formulas given below for grain depth of cut and for wheel wear, using the following notation:

N = r.p.m. of wheel

V = surface speed of wheel, ft. per min.

u = work speed in ft. per min.

R = wheel radius in inches.

r = work radius, inches

f = depth of cut, inches on work radius

μ = interval between grains, inches

S = radius of feed circle = r — f, inches

G = maximum depth of chip, inches.]

Frequency of application depends upon the revolutions per minute of the wheel. Work done is measured by the dimensions of the chip removed by each grain and the total number of chips removed. Kinetic energy is proportional to the

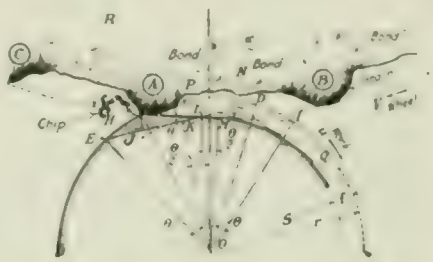


FIG. 1—DIAGRAM ILLUSTRATING THE CUTTING ACTION

mass and square of the velocity of the cutting particles.

Frequency of application of the grain $= N = \frac{12V}{2\pi R}$, and volume of wheel wear $= \frac{12V}{2\pi R} \cdot 2\pi R$. Therefore wheel wear is directly proportional to 12V; or dropping the constant, is directly proportional to V.

The formula for grain depth of cut, as derived in the complete paper, simplified by the omission of inconsequential terms, is

$$G = \frac{\mu u}{V}\sqrt{\frac{2f}{r}} \text{ (approximately)} \ldots [1]$$

From this it is deduced that grain depth of cut varies directly with grain interval, work speed, and square root of radial feed; and inversely with wheel speed, and square root of work radius.

The kinetic energy of the cutting particles increases with the square of the velocity. For a certain depth of cut the resistance of the work to the grain is very nearly proportional to this depth, as the cuts are very small, even when compared to the total size of the grain. Theoretically, for some low velocity the kinetic energy of the grain should just equal the energy required to remove the chip (the feed would be reduced to maintain constant grain depth of cut under reduced wheel velocity conditions) and wheel wear would be caused without any chip being removed up to this point. Actually the bond strength is always sufficient to prevent this condition. Our assumption is then clear that:

Wheel wear varies inversely with the surplus kinetic energy of cutting particles and is inversely proportional to effective wheel surface velocities (wheel speed minus work speed).

We are now prepared to combine factors.

a Wheel wear is proportional to the wheel speed, or to V.

b Wheel wear is proportional to the grain depth of cut, as expressed in Formula [1].

c Wheel wear is inversely proportional to surplus kinetic energy of the cutting particles, or proportional to $1/(V - u)^2$. The term u is usually negligible as compared with V and it may therefore be assumed that $1 V^2 = 1 (V - u)^2$.

From these relations, a, b and c, an index of wheel-wearing action (WW_1) due to grinding (where the wheel face is free-cutting) may be expressed as follows:

$$WW = V \cdot \frac{\mu u}{V}\sqrt{\frac{2f}{r}} \times \frac{1}{V^2}$$

$$= \frac{\mu u}{V^2}\sqrt{\frac{2f}{r}} \quad \ldots [2]$$

Laws of Grinding for Draw-In Cuts

From this expression we may derive the following laws of cylindrical grinding, operative within the usual limits of speeds and dimensions. For straight-in (draw-in) cuts a free-cutting wheel will wear according to the effect of wheel-wearing action as follows:

a Wheel-wearing action increases directly as:

1 Grain interval (grain size—inversely as grade)

2 Work speed (surface)

3 Square root of diametral cut (feed).

b Wheel-wearing action increases directly as the following are decreased:

1 Square of wheel speed (surface)

2 Square root of work radius.

A soft wheel is more susceptible to wheel-wearing action than a hard wheel and will more nearly follow the theoretical conditions. It is therefore more free-cutting and will cut more nearly the full chip than a hard wheel. There is consequently a gain in production as wheels of softer grades are used, all other conditions remaining constant, up to the point where the chips are geometrically perfect for a given condition of speeds and dimensions. It is clear from this standpoint that the softest possible

*Norton Co., Worcester, Mass.

wheel should be used. High wheel speeds up to the safe limit are, of course, necessary if the soft wheels are to perform in a satisfactory manner.

To show the practical application of Formula [2] for wheel-wearing action (Index of Wheel Wear), Table 1 is given.

In column 1 of the table are the work speeds provided on a recent grinding machine, given in order so that actual values can be experimentally obtained to check with the theoretical. In the succeeding columns are two series of values as follows:

1 Following the term "Production" are approximate values for cubic inches of metal removed per minute for a wheel 1 in. wide. These were calculated by the formula, Production = nominal work diameter $\times \pi \times$ r.p.m. $\times$ depth of cut (assumed to be 0.0005 in.), which gives values slightly less than the true values.

2 Following the terms "Wheel Wear" are values of the actual wheel wear obtained by multiplying the Index of Wheel Wear, calculated by Formula [2], by a constant derived by experiment. This constant is for convenience expressed in the form 1800×10^4.

Sample Calculation. In Formula [2] assume:

$u = 53$ r.p.m. $= 13.9$ ft. per min.
$r = \frac{1}{2}$ in. (work diameter 1 in.)
$f = 0.0005$ in.
$V = 6000$ ft. per min.
$\mu = 0.05$
$R = 9.0$ in. (wheel radius)
Substituting,

$$WW_1 = \frac{0.05 \times 13.9}{36{,}000{,}000} \sqrt{\frac{0.001}{0.5}} = 0.0000000196 \times 0.047 = 9212 \cdot 10^{-13}$$

Multiplying by constant given above (1800×10^4),

$WW_1 = 0.0166$ cu. in. per min. for wheel 1 in. wide.

The corresponding "Production" in Table 1 is 0.0835 cu. in.

It will be seen that the wheel-wear values increase rapidly as work speed increases. The value 0.0166 for work of 1 in. diameter at 53 r.p.m. becomes 0.1040 for work of 4 in. diameter at. 167 r.p.m. The same wheel cannot be properly used for both cases, as one sufficiently soft to cut freely in the first case would wear so fast as to be nearly useless in the second case. However, where wheel-wear values are nearly the same we may expect the same wheel to act properly. For instance, a wheel suitable for 1-in. work at 138 r.p.m. wears at the rate of 0.0433 cu. in. per min.; and one suitable for 4-in. work at 72.5 r.p.m. wears at the rate of 0.0450 cu. in per min. In all probability one wheel would serve for both.

Selection of Wheels for Draw-In Cuts

From Table 1, and by experimental tests with various wheels, certain ranges of wheel-wear values may be found which correspond to definite grades of wheels of suitable grain size and abrasive for the material to be ground. Once this is done, the selection of proper wheels is no longer a question of guesswork, as wheel-wear indices may be computed for any set of conditions and the proper wheel selected. The question of the variation in wheels has been reduced to a point where it no longer can be a very large factor, and we may always change our speeds or feeds to correct the action in the proper direction if we understand the laws which have been previously pointed out. As an example of the possibilities of wheel selection, it has been found that for a certain machine the following wheels (Norton system of grade) are suitable for straight-in cuts on mild steel:

Wheel Designation		Wheel-Wear Values. Table 1
36 or 46 J	for values from	0150 to .0250
36 or 46 K	for values from	.0250 to .0350
36 or 46 L	for values from	.0350 to 0450
36 or 46 M	for values of	.0450 and higher

Use no wheels harder than M. For hard materials use a grade softer and No. 60 grain. These values are for straight-in cuts only.

Influence of Feed. As an example of the effect of doubling the feed, let us assume the conditions as above, except that the feed is increased to 0.001 in. (on radius).

$$WW = \frac{u}{V^2} \sqrt{\frac{2f}{r}} = \frac{0.05 \times 13.9}{36{,}000{,}000} \sqrt{\frac{0.002}{0.5}} = 1200 \times 10^{-13}.$$

Wheel wear $= 1800 \times 10^4 \times 1240 \times 10^{-13} = 0.0224$ cu. in. per min. per inch of wheel face. Production is approximately doubled and

$$\text{Wheel-wear increase} = \frac{0.0224 - 0.0166}{0.0166} \times 100 = 35 \text{ per cent.}$$

This indicates how advantageously an increase of feed operates to obtain increased production (up to the limit of grain penetration). If we had doubled work speed we would simply have doubled both production and wheel wear.

Traversed Cuts

The most important development in recent grinding machines is the recognition and utilization of the fact that overall operating efficiency for traversed cylindrical work increases as traverse speeds are increased. (This assumes that for a given traverse speed, width of wheel and revolution of work are so related as to cause the cutting face to just cover the lead of the work.)

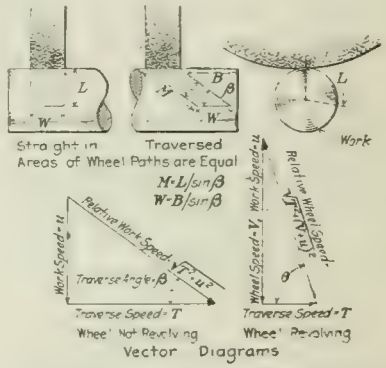


FIG. 2 SPEED RELATIONS BETWEEN WORK AND WHEEL.

Referring to Fig. 2, let

W = width of wheel face

L = length of projected arc of rotation of work

M = actual length of path of traversed cut

B = actual width of path of traversed cut

B = traverse angle

Then $B = W \sin B$; $M = L/\sin B$; areas $W \times L$ and $B \times M$ are equal. Wheel width of cut is proportional to W for straight-in cut, but reduced to B for traversed cut.

It is to be noted that relative work speed has been increased over actual work speed in the inverse proportion of the sine of the traverse angle. This relative increase does not appear in the projected (end view) relations. As these alone affect individual grain depth of cut, we have gained in relative work speed to get over the longer path M so as to cover the same area in the same time on a narrower width, B, without increasing grain depth of cut.

Now if the wheel rotates, each grain cuts across the work at an angle Θ, resulting from speed relations shown by Fig. 2 (vector diagram for rotating wheel). Then the individual grain paths are at a much steeper angle than the wheel path to the axis of work rotation, but we have gained in relative wheel speed without increasing individual grain depth of cut. Our wheel width of cut is also reduced by a slight amount proportional to $\sin \Theta$, which is of course much less than the reduction before the wheel was rotated. The net result is a reduction in wheel stress proportional to $\sin \Theta$ and an increase in work speed proportional to $\sin B$, without increase in grain depth of cut.

TABLE 1. COMPARISON BETWEEN WHEEL WEAR AND QUANTITY OF METAL REMOVED AT DIFFERENT SPEEDS

Work Speed in r.p.m.		Work Diameters 1 in.	2 in.	3 in.	4 in.
53	Production	0 0835	0.1670	0.2500	0.3340
	Wheel Wear	0.1140	0 0286	0.0290	0.0334
72.5	Production	0.1140	0.2280	0.3420	0.4560
	Wheel Wear	0.0226	0.0319	0.0390	0.0450
87	Production	0.1370	0.2740	0.4110	0.5480
	Wheel Wear	0.0273	0.0387	0.0475	0.0546
101	Production	0.1586	0.3172	0.4758	0.6344
	Wheel Wear	0.0316	0.0448	0.0540	0.0635
138	Production	0.2160	0.4320	0.6480	0.8640
	Wheel Wear	0.0433	0.0612	0.0645	0.0865
167	Production	0.2620	0.5240	0.7860	1.0480
	Wheel Wear	0.0522	0.0740	0.0910	0.1040

Wheel diameter 18 in.; surface speed, 6000 ft. per min.; diametral feed per work revolution [illegible] feed), 0.001 in.; grain of wheel, 66F Alundum; material, mild machinery steel.

The "head resistance" against the wheel as a whole is reduced by the sin B factor, while wheel width of cut is reduced by sin Θ. These both directly affect wheel wear. For traversed-feed conditions our grain depth of cut remains the same as in straight-in feeds, but wheel wear is reduced in the proportion of sin $B \times$ sin Θ.

If T = traverse speed, V = wheel speed, u = work speed, then

$$WW_1 = \left(\frac{u}{\sqrt{T^2 + u^2}}\right)\left(\frac{V + u}{\sqrt{T^2 + (V + u)^2}}\right)\left(\frac{\mu u}{rV^2}\right)(\sqrt{2rf}) \quad \ldots\ldots\ldots\ldots\ldots [3]$$

In practical cases the second term will be so nearly 1 that it may be neglected. It is evident that T affects the quantity appreciably only when u is kept relatively low. This indicates that a wide wheel should be used to get the effect of reduced wear for a given production, traversing as rapidly as possible. The above formula assumes no overlapping of the cut.

Now by making assumptions and neglecting values whose effect is so small as to make no appreciable difference for purposes of comparison, we reduce the expressions for WW_1 exactly as we did in the case of straight-in feeds and obtain:

Index of wheel wear

$$WW_1 = \frac{\mu u}{V^2}\left(\frac{u}{\sqrt{T^2 + u^2}}\right)\sqrt{\frac{2f}{r}} \quad \ldots\ldots [4]$$

Laws of Grinding for Traversed Cuts

From this it is evident that for traversed work:

a Wheel wear increases directly with the work speed

b Wheel wear decreases directly as the decrease in the quantity which we term "traverse factor," which is work speed divided by the square root of the sum of the squares of traverse and work speeds

c Wheel wear decreases directly as square of wheel speed increases

d Wheel wear decreases directly as the square root of the work radius increases

e Wheel wear increases directly as the square root of the feed increases.

The value $\frac{u}{\sqrt{T^2 + u^2}}$ in our expression for index of wheel wear is our traverse factor. Where T is large with respect to u this factor will be appreciably less than unity, but as u increases the reduction in wheel-wearing action is less pronounced.

Table 2 gives values of the traverse factor for a certain machine having the work speeds previously given for draw-in cuts, and the following table (traverse) speeds: 10.02, 14.00, 17.00, 19.70, 26.90 and 32.60 ft. per min. The table shows combinations of speeds giving leads from 2.3 in. upward. As the machine was designed for a wheel 2½ in. wide, combinations of speeds giving lesser leads of work are not given.

TABLE 2. TRAVERSE FACTORS

Traverse ft. per min.	Wk. r.p.m.	Lead in.	Work Diameter 1 in.	2 in.	3 in.	4 in.
10.02	[illegible]	2.3	0.810	[illegible]	0.975	[illegible]
14.00	[illegible]	3.1	[illegible]	[illegible]	0.946	0.968
14.00	72.5	2.3	0.805	[illegible]	0.968	[illegible]
17.00	[illegible]	3.8	0.632	0.850	0.926	0.955
17.00	72.5	2.8	0.730	0.910	0.955	0.974
17.00	87	2.3	0.802	[illegible]	0.972	0.985
19.70	[illegible]	4.4	0.576	[illegible]	0.905	0.943
19.70	[illegible]	3.2	0.691	0.884	0.943	0.967
19.70	87	2.7	[illegible]	0.916	0.961	0.980
19.70	101	2.3	0.802	[illegible]	0.971	0.986
26.90	[illegible]	5.9	0.460	0.720	0.839	0.900
26.90	72.5	4.4	[illegible]	0.815	[illegible]	0.942
26.90	87	3.6	0.646	0.860	[illegible]	[illegible]
26.90	101	3.1	0.703	0.890	0.950	0.974
26.90	138	2.3	0.801	0.936	0.960	0.982
32.60	[illegible]	7.35	0.397	0.655	0.790	0.865
32.60	72.5	5.3	0.505	0.760	0.867	0.919
32.60	87	4.4	0.580	[illegible]	0.908	0.945
32.60	101	3.8	0.635	[illegible]	0.927	0.960
32.60	138	2.8	0.748	0.914	0.945	0.977
32.60	167	2.3	0.807	0.936	0.967	0.982

If we now multiply each of the traverse factors in Table 2 by the wheel-wear value for the corresponding work speed and work diameter as shown in Table 1 (draw-in cuts), we will have a table of wheel-wear values for traversed cuts. These products are given in Table 3.

By assigning certain wheels to specified ranges of wheel-wearing action, we may select the proper wheel through the use of Table 3 in the same way that we did from Table 1. Actually in the case of Table 3 the wheels used would be somewhat softer for the same index figure because the actual depth of cut does not follow the indicated depth (as shown by the feeding mechanism) as closely for traversed work as for draw-in work, and therefore the actual cut is not so deep. This means, of course, that the "spring away" action of the work is more pronounced for traversed than for draw-in work. Careful use of steady rests is therefore very essential.

The following wheels are found to be satisfactory for our machine for traversed cuts on mild steel under the assumed conditions:

Wheel: Designation		Wheel-Wear Values, Table 3
36 or 46 I	for values up to	.02500
36 or 46 J	for values from	[illegible] to [illegible]
36 or 46 K	for values from	.04000 to .05000
36 or 46 L	for values from	.05000 or .06000
36 or 46 M	for values from	.06000

Use No. 60 grain for hard material and a grade softer; but use no wheel softer than I.

Important Note.—These statements of wheel assignment are based upon assumptions of the best machine conditions and most careful operation to prevent any abuse of the wheel. Field practice will usually show harder wheels in use due to conditions which abuse the wheel. Efficiency is sacrificed where such is the case.

Production Costs

If wheel wear were the most important element of production cost, grinding efficiency might be considered on this basis without leading to the fallacy which exists to-day. As a matter of fact, the wheel cost is almost negligible compared with the other costs, and wheel selection should be based upon the production capacity of the wheel under the given set of grinding conditions, allowing the wheel wear to be as high as is necessary to get a free action without excessive wear (which would cause difficulty in sizing work and the need for frequent dressing). The all-important factor is the rate at which the wheel may be made to cut and still not get out of truth. This affects the grinding time, any reduction of which is of vastly more importance than an increase of wheel wear which may result from such a reduction.

In good practice the volume of wheel wear is approximately a tenth of the material removed (mild steel) during roughing operations. A conservative estimate of the cost of operating a modern cylindrical grinding machine (ex-

TABLE 4 PRODUCTION-COST FACTORS

Table Speed, ft. per min.	Work, r.p.m.	Lead in.	Diam. of Work 1 in.	4 in.
10.02	53	2.3	3.68	13.45
14.00	53	[illegible]	5.16	18.80
14.00	72.5	2.3	4.95	17.85
17.00	53	3.8	6.00	21.00
17.00	72.5	2.8	6.00	21.80
17.00	87	2.3	5.85	22.00
19.70	53	4.4	6.40	23.70
19.70	72.5	3.2	6.80	23.50
19.70	87	2.7	6.81	23.45
19.70	101	2.3	6.75	23.30
26.90	53	[illegible]	9.05	29.80
26.90	72.5	4.4	9.34	29.85
26.90	87	3.6	9.00	29.00
26.90	101	3.1	9.03	29.10
26.90	138	2.3	9.00	29.15
32.60	53	7.35	11.70	35.70
32.60	72.5	5.3	11.30	34.60
32.60	87	4.4	11.00	33.60
32.60	101	3.8	10.90	33.40
32.60	138	2.8	10.80	33.50
32.60	167	2.3	10.62	32.90

TABLE 3 WHEEL-WEAR VALUES FOR TRAVERSED CUTS

Traverse, ft. per min.	Work r.p.m.	Lead in.	Work Diameter 1 in.	2 in.	3 in.	4 in.
[illegible]	[illegible]	2.3	0.01340	0.02240	0.02820	[illegible]
14.00	53	3.1	0.01170	0.02080	[illegible]	[illegible]
14.00	72.5	2.3	0.01820	0.02450	[illegible]	[illegible]
17.00	53	[illegible]	0.01050	0.02005	[illegible]	[illegible]
17.00	72.5	2.8	0.01650	0.02900	[illegible]	0.04370
17.00	87	[illegible]	[illegible]	0.03620	[illegible]	[illegible]
19.7	[illegible]	4.4	[illegible]	0.01930	[illegible]	0.03142
19.7	72.5	3.2	0.01560	0.02820	[illegible]	[illegible]
19.7	87	2.7	0.02060	0.03540	[illegible]	0.05385
19.7	101	2.3	0.02540	0.04185	[illegible]	[illegible]
26.9	[illegible]	5.9	0.00763	0.01695	[illegible]	[illegible]
26.9	72.5	4.4	0.01290	0.02600	[illegible]	0.04240
26.9	87	[illegible]	0.01760	0.03320	[illegible]	[illegible]
26.9	101	3.1	0.02220	0.03980	[illegible]	0.06185
26.9	138	2.3	[illegible]	0.05130	0.06195	[illegible]
32.6	53	7.35	[illegible]	0.01545	[illegible]	[illegible]
32.6	72.5	5.3	0.01140	0.02420	0.03380	0.04130
32.6	87	4.4	[illegible]	[illegible]	0.04315	0.05180
32.6	101	[illegible]	0.02000	[illegible]	0.05000	0.06100
32.6	138	2.8	0.03230	[illegible]	0.06095	[illegible]
32.6	167	2.3	0.04210	0.06940	[illegible]	[illegible]

clusive of wheel cost) is, say, five cents per minute, including labor at day-rate wages. The useful content of the wheel may be assumed to be such that the wheel is actually worth seven cents per cubic inch. If production could be increased to 2 cu. in. per min. where previously we obtained 1½ cu. in. and wheel wear jumped from 0.15 cu. in., say, to 0.25 cu. in. per min., our first cost would be: $(0.05 + 0.15 \times 0.07) \div 1.5 =$ \$0.0404 or 4.04 cents per cu. in. removed. In the second case, $(0.05 + 0.25 \times 0.07) \div 2 =$ \$0.0338, or 3.38 cents per cu. in. removed.

Now the overall production efficiency of the machine based upon all costs involved is indicated by production-cost factors proportional to the earning rate of the machine. In the first case this factor would be: (production) ÷ (cost) = $\frac{1.5}{0.05 + 0.15 \times 0.07} = 24.8$. In the second case, $\frac{2.0}{0.05 + 0.25 \times 0.07} = 29.6$

It evidently will pay to wear the wheel more in order to obtain the higher rate as the overall gain in the foregoing is about 19 per cent. The above assumed values are reasonable and the figures given might be considered as typical. Table 4 gives these production-cost factors, or relative earning rates based upon these costs and the grinding conditions previously assumed in Tables 1, 2 and 3, the variations being due to traverse and work-speed relations only, but with proper choice of wheels in each case. Then, for the machine which we have used as an illustration it is evident that for work of a certain size and a wheel of a certain width there is one speed combination which will utilize the machine to the greatest profit. If we are able to use wheels of the width needed to cover the lead under the best speed-relation conditions, we will obtain the best earning rate of which the machine is capable. If wide wheels are not available, we still have speed-relation conditions which will give very nearly as high a rate for the narrower wheels.

In Table 4 the production-cost factors are given for 1-in. and 4-in. diameters of work only. The factors may also be expressed as earnings per unit of time, or the relative amounts the machine would earn in equal lengths of time under the various conditions as given.

Note that, due to high traverse, a 2.3-in. wheel which earns \$3.68 in a certain length of time when grinding 1-in. work at low traverse and work speeds, will earn \$10.62 in the same length of time when using the high speeds. If the widest wheel (7.35-in. face) be used the machine will earn \$11.70 in the same length of time. The grade of wheel is suitable in each case according to the speed changes. This clearly shows that high traverse speeds cause a corresponding increase in earnings in spite of the necessary increase in work speed.

Considering the cost of wheels 7.35 in. wide as compared to wheels 2.3 in. wide, and the relative power required to drive the two wheels, it is very evident that the use of a harder wheel 2.3 in. wide would offset the difference in wearing action without greatly reducing production and that the production of the 7.35-in. wheel is matched by the production of the 2.3-in. wheel using highest traverse and highest work speed.

The most striking conclusion from the above is the fact that in order to use a narrow wheel and get great production the high work speed does not cause excessive wheel wear due to the relief on the wheel brought about by the high traverse speed. This traverse speed is also necessary to allow the rapid exposure of fresh work surface to the cutting face, making for a highly economical combination.

The foregoing should demonstrate clearly what this new development in the science of grinding may mean to the art as practised throughout our production shops.

Actual grinding tests upon a machine having the high-traverse feature, and making use of the speeds shown in the table, have conclusively proven the deductions indicated by the mathematical calculations. On mild machine steel (0.15 per cent. carbon) over diameters ranging from ¾ in. to 4 in., production rates as high as 2.00 cu. in. per min. have been easily attained, grinding to limits of 0.0010 in., removing 0.060 in. from the diameter over lengths of from 36 to 72 in.

When machine conditions, truth and balance of wheel, and proper use of steady rests and grinding compound are intelligently and skilfully handled, wheels of 36 and 46 grain size, and grades I to L (Norton system of grading) have been used in these roughing operations. Especially where the feeding is carefully regulated so as never to crowd the radial depth of cut to more than the possible depth of grain penetration (say, not to exceed 0.0015 in. on the diameter) per traverse, it has been found that the wheel face remained sufficiently true to leave a commercial finish of fair degree absolutely free from chatter marks, feed lines or any other imperfections of real or imaginary consequence.

Owing to the fact that in the above the highest work and traverse speeds were used in every case, the grade (hardness) of wheel was increased as the diameter of the work increased. This is in accordance with our formula for index of wheel wear. Instead of considering the work speed and work radius independently, they were in this case tied together by the fact that a constant work r.p.m. was used. The expression for this is as follows:

$$\text{Work speed } u = \frac{2\mu rN}{12} \quad \ldots\ldots\ldots [5]$$

where r = work radius (inches) and N = r.p.m. Substituting [5] in [4],

$$WW_1 = \frac{0.275\mu}{V^2 \sqrt{(T^2 + 0.275r^2N^2)}} \left(\frac{N^2}{\quad}\right) \times \sqrt{2fr^3} \quad \ldots\ldots\ldots [6]$$

Now, if V, N, T and f are made constant, WW_1 must vary as the value r appears in the formula, the greatest effect being the $\sqrt{r^3}$ factor and we would expect therefore to use harder wheels as r increases.

Conclusions

The conclusions to be drawn from the foregoing are definite and indicate positively how to arrive at the solution of precision grinding problems, provided one has an intelligent knowledge of abrasive wheels and the usual materials ground.

Greatest grinding efficiency is obtained by the use of the softest wheels suited to the nature of the material ground. This efficiency is dependent upon the control of the dimension and speed relations between the wheel and the work so that the individual chip may have the minimum depth for a given volume determined by the maximum allowable radial depth of cut. This means long arc of contact, low work speeds and maximum feeds. With these conditions established, increase of traverse speed increases production without increase of wheel-wearing action. Machine conditions must be such as to maintain as accurately as is reasonably possible the speed and dimensional relations of the wheel and the work.

There is an enormous field for the industrial engineer in obtaining better production at less cost in grinding operations. There is a definite science involved, there is no mystery about it. The proper appreciation of the laws of grinding by machine designers and operators is rapidly increasing and we may expect a constant improvement in the art as a consequence.

Too Good To Be True.—A newspaper despatch from Ottawa a few days ago stated: A question answered in the House has whetted curiosity a bit. That answer states that the contract for steel plates with the Dominion Steel Co. has been cancelled and that the Government is not required to pay any damages on account of the cancellation. Explanation of all this is awaited, as the plate contract was large and generally considered fat. That the Government got out of it without the payment of a dollar seems almost too good to be true.

*The figure of 5 cents a minute as time cost of operation is based upon labor at 75 cents an hour and an hourly burden of \$2.25 an hour (power, investment, rent, heat, light, etc.)

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.

The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

We welcome a new name to the list of scale winners. D. G. Gains, engineer, at Montreal, P.Q., was the only reader to send in a correct list. Question No. 4 was the stumbling block. Note how large the request sticks out in this advertisement, then you will see why we listed it as we did.

CONTEST FOR MARCH 31ST ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1. A request for your name and address so that you can get something for nothing
2. A very pertinent question.
3. A machine designed to give rapid and accurate production.
4. A very common requirement
5. Something said to be filling a long-felt want
6. How to save time and money when [illegible] tapping, etc.
7. Something that makes no allowance for error
8. A product that will stand gruelling punishment
9. A machine that has three important features
10. Something of value that is given free
11. A seemingly foolish question
12. Something that offers indisputable evidence

These are Correct Answers for List from March 10th Issue:

1—Kearney & Trecker.
2—The Tube Co. of Canada.
3—J. C. McLaren Belting Co., Ltd.
4—Hamilton Gear & Machine Co.
5—L. S. Starrett Co.
6—Canadian Blower & Forge Co.
7—A. R. Williams Co.
8—Keller Pneumatic Tool Co.
9—Murchey Machine & Tool Co.
10—Cleveland Pneumatic Tool Co. of Canada, Ltd.
11—John Bertram & Sons Co., Ltd.
12—Dominion Steel Products Co., Ltd.

Closing Date for This Contest is April 21st.

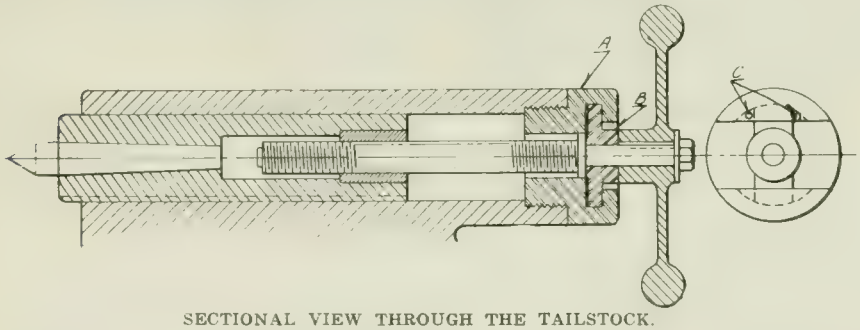
WHAT OUR READERS THINK AND DO

QUICK ACTING TAILSTOCK

By John Homewood

Desiring a quick acting tailstock for our spinning lathes, here is what we did. We replaced the regular rear thrust cap with a steel one of the type shown at A on accompanying sketch. This cap was bored out to allow the screw to slide through. A tee slot was placed in this cap to form a seat for the latch B as shown, this latch being free running on the screw.

When we desired to release our tailstock, we gave it a quarter of a turn, and pulled it back out of the way. To bring into service, we merely pushed it up, gave it a twist and tightened it into place. In action the lock is turned around in its seat and strikes the stop pin C. We found that this idea saved considerable time and gave satisfactory service.



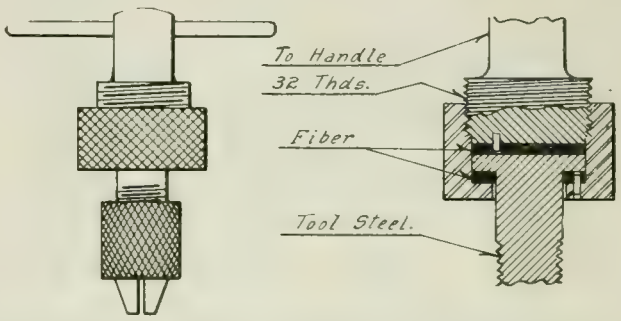
SECTIONAL VIEW THROUGH THE TAILSTOCK.

HOW TO PREVENT SOME TAP BREAKAGE.

The drawing shows a friction tap wrench—a tool that it will pay any shop to have for smaller work. It is the familiar T wrench, but with a change in the stem, which is divided midway between chuck and handle for the friction device.

The sectional view shows how the friction works. It has the same construction as the safety tapping devices on the market. A divided shaft, one member of which is flanged to make the "friction" surfaces against which fiber collars bear, is united by a threaded coupling that may be set to any tension desired in accordance with the apparent strength of the tap or the material being worked.

The assembled wrench is neat in appearance and is a first class safety in any hands but the most indifferent. As with all friction tappers, it should be loosened up when starting on a new job —it will then slip, but can be set up tighter until the slipping is reduced to a reasonable amount.

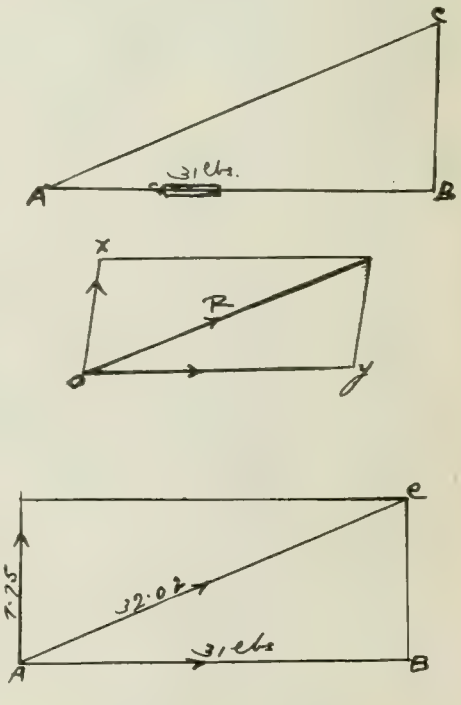


SECTIONAL AND DETAIL VIEW OF THE TAP WRENCH.

COMPOSITION OF FORCES

Question:—A B C is a triangle, of which the angle B is a right angle and the sides A C and B C are 60 inch and 15 inch respectively in length. The spring balance D is subjected to a stress of 31 lbs. What are the components of the stress on D along A C and B C ?

Answer:—What our correspondent is after is, we think, an explanation of the resolution of forces. His question is stated in a rather peculiar manner, as there is no need to suppose the presence of a spring balance. A force of 31 lbs. acts along the line A B. Now this force would be one of the components of the resultant force, which is expressed in magnitude and direction by the diagonal of the parallelogram of forces. Any two forces acting through a common point, can be resolved into a single force acting through the same point in the following manner. Let the lines OY and OX represent in magnitude and direction two forces acting through the point O. If we complete the parallelogram as shown, the diagonal will represent in direction and magnitude the resultant of the two forces. Similarly if we have a single force we can resolve it into two forces at right angles to each other. In the case given we can assume the two forces to be acting along BC and AB through a common point A. The force acting on the BC will be equal to AB sine A, which is taking the measurements given, 31 x 15/60, while the force acting on AC is equal to AB/cos A, which is 31/.968. These give us respectively 7.75 and 32.07 lbs. The component forces are 7.75 and 31, while the resultant force is 32.02.



RESOLUTION OF FORCES.

FIVE SHORT CUTS

By J. H. MOORE

IN describing this short trip through a certain plant, it is only fair to state that the ideas about to be told were picked at random, and noticed while on the walk, so to speak. In a way, there is a lesson to be learned from this, viz., that it is wonderful what you can notice while on a tour through any plant. It pays to keep your eyes open and your mind clear, for you never can tell when some real idea may appear.

The first thing I noted was the spinning of some rivets. The work being accomplished was the riveting of small spring steel clips to spring steel grain tubes. "Didn't you use to do that by the hammer method?" I enquired. "Yes," was the reply, "but we broke so many tubes that we decided to adopt the spinning method. Since the new machines have been installed we have had no further trouble. Production is satisfactory, and we get just as good results."

The next thing that aroused my curiosity was a double punch die. The punch die section itself was only about 4⅛ in. wide, yet two separate rows of punches were plainly visible. "What's that used for?" I asked.

"That's the die for punching the platform," came the reply, my informant knowing that I was familiar with the shape of the piece in question. For the benefit of readers let me explain that this particular piece called the platform is made of sheet metal and is about 36 inches square. On all four sides is a row of holes, these of course varying in size, and even in center distance. Having worked at this plant in days gone by, I knew that the big idea in those days was to make an elaborate die that would punch all holes at one stroke. "Did you never make the big die?" I asked, and laughingly came the reply, "I should say not. After we drew up the plans and estimated the cost, we found it would run us about $3,500 or more. This was a rather imposing figure and we shelved the matter indefinitely. Suddenly the idea you see before you was suggested. As you can notice, the dies are placed in an ordinary standard die section, which in turn fits our standard bolster. Each die is an insert, therefore is easily replaced when worn, and at very little cost. The same condition holds good for the punches. In punching one side, we use the first line of punches, while for the others we use the second line. A simple gauge guarantees the position of the stock, and although we have to handle the work twice, the production is splendid, at the same time the upkeep of the die is practically nil. Instead of $3,500 (the cost of the elaborate die), the one as used cost less than $500, so you see it was a good move all around. It's just another story that goes to prove that elaborate ideas are not always the best. In case you imagine me prejudiced let me show you one example of misplaced effort."

WE WANT IDEAS

It is our earnest wish to make this section a real help to every reader. It is only by an interchange of ideas that such a condition can be made possible. Why is it that we do not receive more short cuts and machine shop kinks for this department? Is it because there are no new ideas, or time-saving kinks in existence?

Of course not, for in every shop throughout Canada there are little stunts and devices in use that we want to tell about. We cannot see them all, so it's up to the readers to tell us about them.

Do not bother about your style of writing. Send us an idea that's worth while, and we will soon whip it up into shape. Send us a sketch or a blueprint of the device, together with your own style of description, and we will do the rest.

Not only that, but we'll pay you a good price for every article published.—Editor.

Soon we were standing at a long die that looked very much like a dam for a lock. There was a wheel attached, this in turn moving a vise up and down a slide. "This is what I call exhibit A," remarked my guide. "The work which it was supposed to accomplish was the bending of a piece of sheet metal to a certain angle. Without my knowledge this was wished on me, but I never even used it, as the time it would take to bend a piece on the fixture is over twice what it takes to do it by hand. What we actually do is this. A girl takes the piece of metal, holds it a certain distance over the bench, and hits it a blow with a wooden hammer. The complete operation is accomplished in less time than it would take to place the piece in the fixture, so you see this is yet another story to prove that before a change is made it is well to study all the angles of the case."

Milling Fixture

The next scheme noticed was a fixture used in milling keyways on some shafts. The fixture was made in double style, that is, two duplicate fixtures on the one main casting. This of course allowed the unloading and reloading of one fixture while the work was being performed on the other. Six pieces were held in each jig, and strange to say all six pieces were gripped by one main handle. On investigation I found a series of eccentrics underneath the fixture, these operating the float clamps on top.

A point that I couldn't help but comment on was how easy the pieces came out of the vee blocks, and on inquiry here is what I found. The lower vee block was the regular 90 degree style—but, the top clamps were bevelled 40 degrees, not 45, so that the slight change in this angle made all the difference in removing the pieces from the jig.

The last scheme that I noted was not so much a new fixture as a new machine. "Didn't you used to plane your drop die blocks?" I asked. "We sure did, but found it cheaper to purchase that special manufacturing miller you are looking at. Where before we took from three to five hours for each block, we can now complete a set every 2½ hours by the straddle mill process. We find it easier to keep the different faces square with each other, and we do not tie up our planers as we did before."

These ideas are not by any means world beaters, but just ordinary everyday problems met with in the average shop, and go to show what can be accomplished by sticking to the problem in hand.

BURNING FUEL OIL

Set the burners open wide,
Do not touch the valves at side;
Keep the pressure on the pump,
And up the bally steam will jump;
If the smoke is black and thick,
Open up the fans a bit;
If the smoke is thick and white,
To slow the fans will be quite right;
For when sufficient air is given,
No smoke ascendeth up to heaven.
If the jets refuse to squirt,
Assume the cause is due to dirt.
Should the flame be short and white,
You have combustion clear and bright;
But should the flame be yellow and long,
Combustion is entirely wrong.
A wise man to his heater sees,
And keeps it 200 degrees;
To have it more is not quite wise,
Because the oil may carbonize;
A little lower has been found
To give as good results all round.
If the filters are kept clean,
No rise in pressure will be seen;
But should the pump kick up a ruction,
There's likely air within the suction.
The pressure governs the supply,
So do not keep it very high.
If these instructions you will follow,
You'll beat the other fellow hollow.

Extract from "Marine Engineering Knowledge," W. C. MacGibbon.

RESISTANCE OF BODY

Measurements have been made during the past few months by the American Bureau of Standards of the electric resistance of the human body, the measurements being made in such a way as not to include the resistance through the skin where currents entered and left the body. By eliminating the large and uncertain resistances through the skin, results were secured which are said to be more consistent than any previously obtained. These show that the resistance of the same part of the body of different individuals may differ by a ratio of three to two or even more, the resistance of a person changing from day to day and often by small amounts in an hour. The resistance also depends to some extent upon the position of the body and the extent to which the muscles are relaxed.

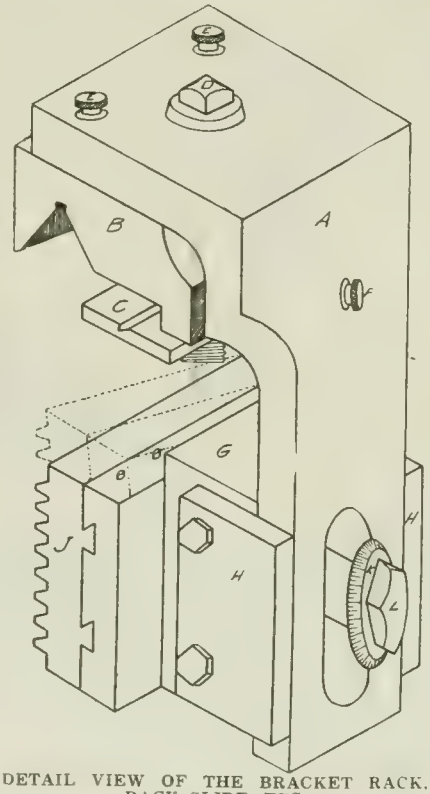
DEVELOPMENTS IN SHOP EQUIPMENT

THREAD LEAD-SCREW VARIATOR

The Precision and Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa., is manufacturing a lead-screw variator for lathe attachment. The variator is built in two models of similar design but different size. The Model "A" is adjustable to fit lathes up to 12-in. swing. The Model "B" to fit lathes from 13-in. to 20-in. swing. The normal length of travel for the carriage is 6 inches, but greater lengths can be provided

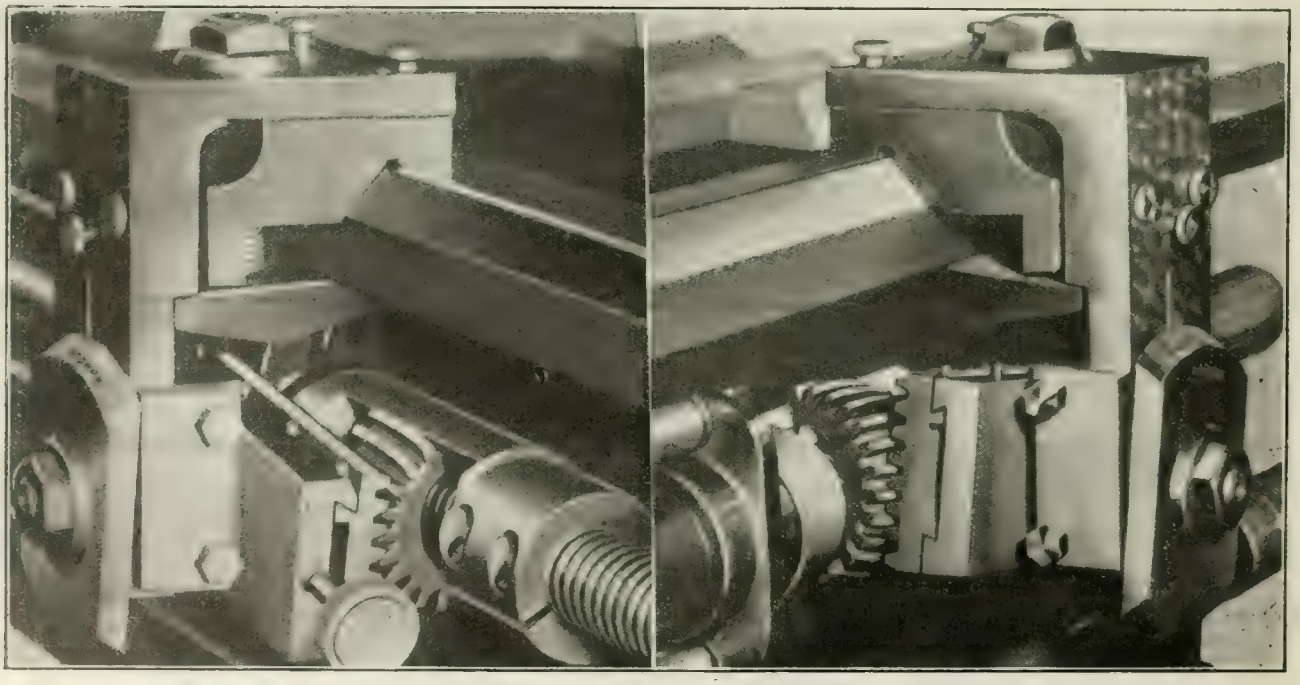
This device is intended for elongating or diminishing the normal lead on lathes, also for correcting errors in the lead of the screw. It is used to aid the ordinary lathe to perform precision thread cutting, and metric threads can be cut without the use of translating gears. Briefly, here are the main points of the device.

The stationary part of the device consists of a bracket, clamped on the ways of the lathe. This bracket is composed of two pieces, the outer frame and the ways adaptor. These can be seen on sketch. The outer frame is adjustable horizontally sufficiently to make the proper connection between the bracket and the mechanism carried on the lead screw. The bracket carries a swiveling rack and provision is made for vertical adjustment to bring the center of the rack pivot in line with the center of the lead screw. The adjustment can be locked, and subsequent tilting of the rack does not disturb it. A dial is provided, to show the degree of inclination of the rack.

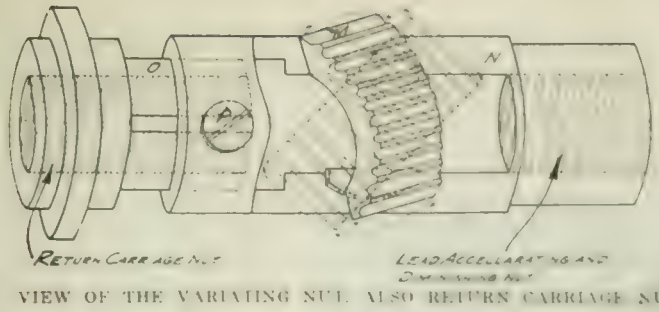


DETAIL VIEW OF THE BRACKET RACK, RACK SLIDE, ETC.

The mechanism on the lead screw consists of an adjustable nut, having an extension carrying a gear segment that is free to swivel in line with the rack. The variation in the lead is obtained by the rotation of this half gear, in accordance with the angle at which the rack is set, as the nut is traversed by the action of the lead screw. The lead-screw nut in the lathe carriage is not employed, but the connection is made between the variator nut and the carriage by the two rods and plate. The variator nut moves the lathe carriage only during the machining operation. The return of the carriage to its initial position is obtained by a second nut, keyed in the frame of the variator nut to permit longitudinal movements independent of those making variations in the lead. The two views shown illus-



THESE TWO VIEWS SHOW THE DEVICE AT THE START AND FINISH OF THE TRAVEL.



DETAIL VIEW OF THE VARIATING NUT, ALSO RETURN CARRIAGE NUT

trate the device at the beginning and end of the traverse.

A dust guard is furnished to protect the lead screw from abrasive dust when performing grinding operations. It is recommended that the variator be positioned near the tailstock end of the lathe, as that part of the lead screw is generally but little used.

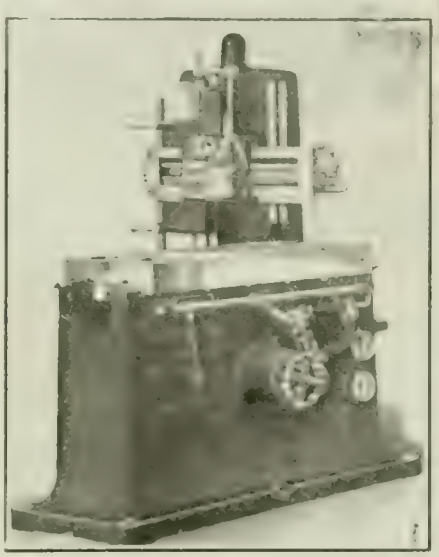
In order to aid in setting the lead variator for either the normal lead of the screw or for a change of lead, a gage block is provided. The block is used by clamping it directly upon the threaded work, it fitting all diameters up to 3 inches. The block is 1 inch thick, so that by turning the work through the same number of turns as threads per inch required and measuring the travel of the carriage by a dial indicator on it adjusted to fit the block, the variation of the pitch of the lead screw can be determined. The desired pitch can be obtained by varying the angle of the swiveling rack to suit the conditions, and then locking it in place.

The device is said to be particularly useful in the manufacture of taps and thread gages, as the necessary correction in the lead can be made while machining, in order to compensate for changes of size during heat treatment, thus reducing the amount of grinding required after hardening. Of course, a sample is first made up from the stock to be used, so as to ascertain the correction necessary.

SHAPING PLANER

The Automatic Machine Co., Bridgeport, Conn., have placed on the market the Coulter shaping planer as shown in photograph. A feature of this machine is the combination clutch and brake mechanism operated from the front, by means of which the table can be stopped and started instantly without bothering the motor or countershaft. In fact, with this arrangement, no countershaft is necessary on the belt-driven model, as it can be belted direct to the main line shaft, saving ceiling space where head room is limited. A length of stroke indicator is provided, also clamps for clamping the down feed while the cross feed is working, or vice versa.

The clutch-brake mechanism consists of a raybestos-lined brake and a main driving pulley made up of two concentric wheels, the inside rim of one and the outside rim of the other being beveled at an angle which by repeated tests has been shown to be most satisfactory for the purpose. When by movement of the operating handle the clutch is thrown out, the brake is simultaneously applied and released again when the clutch is thrown in. There is a split nut on the driving shaft so that the amount of friction in the clutch can be adjusted. The large bearing surface and large diameter means the minimum of wear, the maximum of torque for the minimum of friction, absence of any appreciable heating, and the arrangement is so simple that there is nothing to get out of order. From this friction pulley the power is transmitted through sliding gears of large diameter to a bull wheel and crank which drives the table similar to the mechanism driving and shaper ram. The transmission shafts of this driving mechanism run on ball bearings.



GENERAL VIEW OF THE SHAPING PLANER.

This machine has the shaper advantages of quick return stroke; variable speeds and ability to cut to a shoulder are combined with planer accuracy and table capacity. The maximum stroke can be taken anywhere on the table by merely positioning it under the tool without disturbing the work, and this maximum stroke can be taken with the same degree of accuracy as a shorter one.

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AND MANUFACTURING NEWS

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Can You Stand Competition?

KEEN competition is the one outstanding feature of business in the machine tool, small tool, iron and steel markets at the moment.

Prices are being cut where it is possible. Machine tool dealers are more or less barred from this practice because they have nothing to do with setting prices. Their schedules are furnished by the makers of these machines.

It is a buyers' market now, and it is going to remain a buyers' market for some time.

Some dealers argue that this keen competition is simply the result of an effort to reduce high-cost stocks.

It is in part, but never lose sight of the fact that the same ability to produce that filled these warehouses is still in existence.

The capacity for making steel in Canada is increasing. Since the war there has been laid down a plate mill in the East with very large capacity. In Hamilton there has just been completed another rolling mill, and at Ojibway there is in process a plant that will turn out a large range of steel and iron.

The automobile plants are becoming more highly organized every week. Their combined capacity, were they running full tilt, would exceed anything we have yet known.

Foundries that specialize are coming into existence. Some of these are million dollar concerns, equipped in the last word of new devices for speed and efficiency.

It all means that there is going to be large production—output on an unprecedented scale.

It means that there is going to be more competition in Canada—not less.

There is nothing theoretical or imaginary in this. Any one who keeps in touch with developments can verify it in his own line.

The firm that is efficient—that serves its customers truly and well—that is so equipped that it can turn out a good, reliable article at a marketable price, will get business.

The machine tool house, or the steel warehouse, that has its fingers on the markets, that keeps its customers well and faithfully informed of what it has to sell, will get business.

If you are not in a position to face stiff opposition in your line, your business future is not certain.

We are having business competition in Canada right now and we are not going to have less of it as days go by.

The Recovery of Germany

THIS paper has published in the last few weeks the opinions of a number of Canadian manufacturers regarding German trade. It is only natural that the subject should be a very delicate one, but it is more real than delicate and must be faced.

German competition is going to face Canadian manufacturers, whether they want it or not. Our manufacturers have a right to ask for protection against cheap German labor and German dumping, if, coupled with it, goes protection for the consumer.

Charles M. Schwab has returned only recently from six weeks spent in Europe, in which time he made it a point to get in close touch with German trade affairs. He states:

"Germany will recover from the effects of the world war much sooner, perhaps, than any other European country involved in it.

"Germany is a conquered country and her people are aware of it, but they are like a strong man who has failed in business and sets his teeth determined to win back what he has lost by hard work and competent management. The secret of Germany's industrial success was the efficiency of her workers. They still have that efficiency and that training that is necessary to win in the world of commerce and manufacture. Business is bad, of course, in Germany, as in all other countries, including America, but it is on the mend."

Instances are also coming to the surface that show the sort of competition Canadian manufacturers, or any others for that matter, must be prepared to face from Germany. Prices are being named in more cases and these give something concrete on which to base comparisons. An English correspondent writes as follows:

"One example, amidst hundreds given me, with papers and contracts to support it, is quite sufficient. The representative of a big English business house said he had just secured the entire foreign output of the Solingen factory, manufacturing machetes for Cuba, South American and African plantations. The price was $1.50 a dozen up to 10,000 dozen and $1 flat for orders above 10,000 dozen. The best England could do for goods of the same quality was, he said, $2.25 a dozen, with no reduction for large orders. He did not know United States prices exactly, but was positive they were above $1.75 for the same goods."

So there you have it. Canada has not got to face the matter of selling much to Germany, except it be raw material, because German currency is all against such a development. Germany selling to Canada is the real problem. Is Ottawa prepared to deal intelligently with this matter—in such a way that justice shall be done to our industries and no injustice to our consumers?

A firm of importers in Trichinopoly, South India, writing to Canadian Machinery, asking for sample copies of this paper, address us as follows: "Canadian Machinery, Montreal, Canada, U.S., America." And so with all that tender care and routing, the letter reached us right side up.

The National Association of Purchasing Agents is behind a movement to make a contract sure—a thing that cannot be called off and discarded at the whim of the should-be purchaser. If they can root this sow thistle out of our industrial garden more power to them.

Is Russia Ready for World Trade Yet?

THE matter of opening up trade with Russia is attracting the attention of the world. Several Canadian companies that formerly had big business connections there frankly admit that they do not know very much—if anything at all—about what has been going on since they pulled out.

These concerns are far from satisfied that there is anything sufficiently stable on which to build a trade that would be worth while.

To put the matter short and pointed, their first question would be: Who is going to pay for the goods?

It has not taken Herbert Hoover, Secretary of Commerce in the Harding government, long to make a pronouncement on the question of trading with Soviet Russia.

In the issue of March 22 of the U.S. official Daily Consular and Trade Reports, Mr. Hoover states:

"The question of trade with Russia is far more a political question than an economic one so long as Russia is in control of the Bolsheviki. Under their economic system, no matter how much they moderate it in name, there can be no real return to production in Russia; and therefore, Russia will have no considerable commodities to export and, consequently, no great ability to obtain imports.

"There are no export commodities in Russia to-day worth consideration except gold, platinum, and jewelry in the hands of the Bolshevist government. The people are starving, cold, underclad. If they had any consumable commodities they would have used them long since.

Little Red Riding Hood Isn't Sure That It's Really Grandma

A Period of Destruction

"No better indication of the destruction of production under the Bolshevist system exists than in the case of flax. Pre-war Russia produced 500,000 tons of flax per annum and the country consumed 120,000 tons. The production in 1920 was about 40,000 tons—with mills and lands at least capable of spinning 120,000 tons and the population underclad. In any event, no consequential export flax is available, nor ever will be available, under this economic system.

"Nor can trade with Russia under a government that repudiates private property be based on credit. Thus the whole question from a trade point of view develops into furnishing commodities equal to the gold, platinum and jewelry, variously estimated from $60,000,000 to $200,000,000, in the hands of the Bolshevist government; and after that has been expended there can be little expectation of continued trade. There has been no prohibition on trade for a long time so far as exchange of commodities is concerned. Trade is open through the Baltic States, and Italy has been trading in the South. The real blockade has been the failure of the Russians to produce anything except gold and platinum to trade with.

Who Owns This Gold?

"There has been but little trade for gold because its title has been called into question by the French Government and by threats of private actions in the courts on the ground that it is stolen or subject to foreign liens. It is apparently the intention under the British trade agreement to allow this matter to be threshed out, so far as England is concerned, in the British courts. The terms of the German agreement in this particular are unknown. If any one European nation accepts the gold, no doubt all of them will.

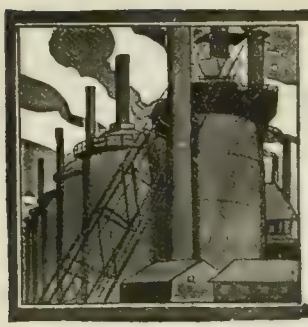
"Europe cannot recover its economic stability until Russia returns to production. Trading for this parcel of gold would not effect this remedy—nor would the goods obtained by the Bolsheviki in return for it restore their production. That requires the abandonment of their present economic system."

Now there is no doubt a great deal of truth in the stand that Mr. Hoover has taken, and it can be accepted as being the attitude that will be taken by United States, as Mr. Hoover would hardly make such a statement off his own bat.

The weakness of the whole situation is that so many nations in the world are so keen for business with gold behind it, that the prospect of trading with Russia as long as the gold hangs out, will be too strong to be resisted.

The man who has been sitting back for months waiting for prices to hit rock bottom has nothing much more to show for it than a pair of shiny pants.

Wages paid to the war-shop mechanic are done for in this country. The skilled man, who has seen years of study and whose advice and work are worth while, should have every consideration in wage adjustments. In pre-war years he was seldom paid sufficient to compensate for his years of training and study.



MARKET DEVELOPMENTS

More Factories Are Starting to Work

Pittsburgh Reports a Slight Improvement in Buying, Although Production is Still Very Low—Getting Rid of Stocks is the Chief Business Yet of the Warehouses Here

CONDITIONS in general are undoubtedly moving in the direction of a better period of trading for the machine tool market. Sales are not increasing, nor can it be said that worth-while prospects are on the increase, but there is an improvement in the operations of several of the industries that are the best customers of the machine tool dealers.

There have been a number of reductions in the price of tools since the first of the year, but of late the number of these has fallen off and prices seem likely to stand for the present.

The steel market is the centre of interest for the moment. There are those who want to see the Steel Corporation take the lead and make a new schedule more in line with the present prices of other commodities and again there are those who wish to see prices left where they are. The latter group is composed largely of firms with stocks on hand that they would like to work off in the present market. There are all sorts of rumors in the steel market as to what is likely to happen and when, and in the absence of anything authoritative these are all more or less uncertain, but they all have the effect of making the buyer believe that a better price is coming and in such an atmosphere he is going to buy about pound for pound of what he actually needs.

A number of steel prices have been marked down recently and there has been a drop in tubes, plates, sheets, bar mill material and other small lines. The market as it stands lacks stability and the anxiety to secure business makes any of the prices quoted more or less liable to sagging.

The market for small tools, drills, reamers, cutters, etc., is quiet and sales are made for actual use. Price cutting, according to the dealers, is being freely indulged in and the market is much in favor of the buyer.

There is no rift in the cloud that has been hanging over the scrap metal market for months now. Dealers are practically out of the market, even at the low levels that are in use now and are taking on nothing unless they see right ahead of them a place where they can dispose of it to advantage or to cover a contract.

MONTREAL REPORTS QUIET WEEK, BUT FAIR SALES IN SOME LINES

Special to CANADIAN MACHINERY.

MONTREAL, March 31.—Industrial conditions during the past week have varied but little from those during the first quarter of the year. The second quarter shows no promise of immediate betterment, but encouraging reports have come in of greater inquiry, usually for small lots, but generally well distributed. One phase of the present situation that tends to develop nervousness is the uncertainty that pervades the railroad conditions, particularly in the relation that exists between executives and the workmen. The possibility of concerted effort on the part of the former to revise the working conditions, and a determined attitude on the part of the employees to reject any proposal of this nature, gives rise to the belief that labor troubles will, during the coming months, disturb the stability of the present quiet, but otherwise sound, industrial outlook. Railroad shops in this district have suspended operations in repair departments for about ten days. Reports from various trade representatives appear to emphasize the fact of industrial dullness, and the consensus of opinion seems to give weight to the statement of one dealer that he "did not look for any marked improvement before midsummer, although light but regular business would continue throughout the spring months."

Commenting on business conditions, a Canadian manufacturer stated: "It is my belief that from now on we will experience changed conditions in commercial activity, particularly in the way of stocks carried. In past years it has been a recognized practice, especially in the retail business, to lay in a three, six or twelve months' stock of commodities, but during the past year this principle has been reversed, the result being that retailers, and even jobbers, are finding it practical and profitable to carry light stocks and replenish their supplies more frequently. Just recently I was informed by a certain retailer that his stock during the past nine months had never exceeded 50 per cent. of what it was prior to the war, and yet the total turnover was but a small fraction below that of pre-war business. This, of course, reacts on the wholesaler or jobber, but more in the size of the individual orders than in the aggregate year's sales." This statement applied particularly to retail business, but it likewise reflects the condition that has existed, and which may be continued, in metal working industries. Manufacturers and consumers will probably be content to operate on smaller "on hand" stocks, working on the basis of covering more frequently. As stated by one dealer here: "The trade has operated on a hand-to-mouth system for many months back, so that the idea has become a habit, and it would not be surprising to see this attitude a feature of future trading, especially as long as present uncertainty dominates the situation."

Steel plate movement has declined in volume; railroads and shipyards are taking less material, the order for the day being for single plates rather than for tonnage supplies. One tank manufacturer here stated that their business was

quite good with work on the books for several months ahead. Spring activity is expected to add to the sheet demand. Revision has been made in quotations on sheets. No. 28 black has been reduced to 6½ cents, while blue annealed are quoted at 5½ cents. Galvanized sheets are lower, the prices now being 8¾ cents for No. 28 and 5¼ cents for 10¾ oz. Queen's Head and Fleur-de-Lis have also declined.

Keener Competition in Selling Tools

That business in this locality is not as bad as in many of the large American centres was shown in a statement by a United States business man this week, here on a visit to their Canadian representatives. He said: "'Business conditions here are much more satisfactory than in the States. Many of your plants here are running on short time, some of them even with reduced staffs, but over there a great many factories are closed down entirely, and have been for some time, with little hope of early betterment. I find that sales here of our products are relatively much better than at home." Some activity has been reported in the way of machine tools, mostly for new lines to be manufactured or where new departments are being opened by engineering firms. Marine shops are preparing for a busy season. One firm here, not previously engaged in this work, has established a marine repair department, and additional machines have been installed for carrying out the work. The general tool demand is quiet, and supply movement shows a little falling off, with keener competition featuring the selling market.

MARKET REMAINS RATHER "SPOTTY"

Price Conditions Have Quite a Bit to Do with Sales—Price Cutting Is Being Indulged in

TORONTO.—The used machine is still figuring quite largely in the Canadian market, especially in the woodworking field. In fact some of the dealers are doing a very good business.

The metal working machine tool trade is quiet. Some sales are being made, but they are not large, and inquiries are not as promising as they were a few weeks ago. The matter of prices may or may not have something to do with the matter of sales not being closed. It still provides the would-be purchaser with a talking point, though, and there are times when he makes the best of it.

Dealers have had many notices of reductions in the prices of machine tools since the first of the year, and there seems to have been a let-up in the movement during the past week or so. One of the firms was making comparisons in the prices of lathes now and at previous times, finding that one well-known maker, in his last price list, which included a reduction of about 15 per cent., had almost duplicated the list which had been issued for 1918. Of course the 1918 prices are well in advance of the 1914, but it is not held in any quarter, as far as we can find out, that there will be a return to anything like that price. As is always the case, when a price is cut, the question that comes first to be answered is, "Will there be another reduction?" Getting the machine tool market established on anything like a working basis, where buyers will have confidence in prices, is quite one of the largest problems that the trade is facing now.

One well-known machinery house told this paper to-day that the month just closing was one of the best they had experienced in used equipment, especially for woodworking shops. He attributed this to the fact that building is getting under way in a good many of the centres where costs are not quite as excessive as they are here. Then he considered that the price had a great deal to do with it. Some firms were anxious to increase their output slightly, and did not feel able to take on an extensive line just now. They were turning to the used tool market.

Motors, this same firm claimed, were moving out slowly at present. Some weeks ago there was a reduction of about 7 per cent. in this line, but prices are weak, and the trade seems to think there is going to be another break.

In the Steel Market

Many of the warehouses are still busy liquidating their stock, and there is not a great deal of money being made in this business. There is a growing expectation, and one hears the story many times, that the selling schedule of the Steel Corporation is to be revised downward. Officials of the company in Canada who would be likely to know, were any information being given out, claim they have heard nothing about it. But the story runs something like this, as Canadian Machinery heard it in several places to-day:

"Corporation prices are going to be altered and the new schedule will be given out on April 15, when it will be seen that bars will be down to 1.75." April 15 is not far away, so it will soon be seen whether or not this guess is good for anything.

One merchant declared that he was quite satisfied to see the Corporation price stay where it is. "Were a cut to be made, it would mean that we would have to write off a good-sized sum on every ton in our stock, and there is quite a bit of material there that was brought it from the premium mills. Of course, it may be that when buying starts prices will improve, and we will get some of the loss back, but it is a chance in business that we must all take. We can't win all the time. Certain it is there are few wins to be scored in the present market."

Sheets Fairly Active

A fair business is being done in sheets, particularly galvanized. Some of the stove makers have been taking in a fairly good tonnage from the jobbers this week. This may mean that the stove business is very poor, and that they would rather let the warehouse take the chance on a price, and they buy in small quantities rather than stock up from the mills themselves.

This is hardly the season for plate, but very little of it is being sold. We quote plate from warehouses at 4.75 for 3-16-inch and 4.25 for ¼-inch and up.

The competition for business in bar mill material is still keen, but dealers do not show quite the same eagerness to put nicks in their prices as they did a few weeks ago. We are quoting iron and steel bars at 4.25 this week, although it is known that some of the warehouses

POINTS IN WEEK'S MARKETING NOTES

The big question in the steel market this week is regarding the attitude of the Steel Corporation on its price schedule. Some reports say that this will come out on the 15th of April, but there is nothing official about this.

—

The Steel Corporation is producing this week at between 10 and 13 per cent. of its capacity.

—

Pittsburgh says that bars are selling at 2 cents in carload lots.

—

Pig iron is selling at $25 at Pittsburgh, and some sales have been made at $1 under that mark.

—

The warehouses in Toronto district are quoting iron and steel bars at 4 4½ cents per pound.

—

There is a very small demand for plate, and warehouses here are quoting $4.75 for 3-16-inch.

—

The sale of small tools is going on in very limited quantities, consumers buying only what they need from day to day. Several of the dealers were complaining this week that prices were still being cut. As the market stands it is very much in favor of the buyer.

—

There is no improvement in the scrap metal situation this week. Dealers will not guarantee to pay the prices quoted on another page of this paper. Many of them are out of the market entirely.

are doing four cents on anything that looks like a desirable order.

Black sheets are quoted at 6.50 for 28 gauge, and blue annealed at 5.50. Galvanized 28 at 8.50 and 10¾ oz. at 8.90. These prices may be regarded as fairly indicative of the market, although we are willing to admit there may be several cases in which a figure more favorable to the buyer has been quoted.

Tubes are moving out on a fairly good basis. Prices have been revised downward this week, and local warehouses for the most part are quoting $40 for 100 feet of three-inch lapweld and $49.25 for seamless. The repair business in boilers seems to be keeping up in fairly good shape. Every effort is being made to make existing equipment do for a while longer.

Small Tool Market

There is not much business going to the dealers in small tools just now. Although some of the firms that are generally counted upon to use large quantities of this class of supplies are getting under way they seem to be fairly well stocked. Competition continues keen for anything in the way of a decent sized order, and some of the dealers are always ready to tell a yarn about the way some of the prices are being pared in order to take home an order. Files, too, are being sold in somewhat the same way, some of the jobbers going so far as to claim that some makers are giving prices lower than those that could be obtained for them by the jobbers.

AUTO PLANTS ARE RUNNING BETTER

And From This the Machine Tool Market Sees Encouraging Signs For the Future

Special to CANADIAN MACHINERY.

NEW YORK, March 31.—While there is undoubtedly a better tone in the machinery markets, this is not yet reflected in any important increase in orders. Inquiries have improved, both as to number and volume, but prospective purchasers are slow in closing. A distinctly better condition is apparent in used tools.

There are three large lists still pending, and just how soon action will be taken is not known. The American Sugar Refining Co., which recently inquired for about fifty machines for a repair shop at its Baltimore, Md., refinery, has given some indication that it may place orders within a week or two on at least a part of its list. The Batavia Car Works, Batavia, N.Y., is expected to buy mostly used tools. Its list called for about twenty-five or thirty machines. The General Electric Co., which two weeks ago issued an inquiry for thirty miscellaneous machines, may not buy all of the machines on this list. It has been found that its requirements at Schenectady can be met in part by moving machines from one department to another. Just how extensive its purchases will be, therefore, remains in doubt.

The declines in prices which have recently taken place have affected nearly all important types of machines, but not all manufacturers have reduced. Many of the lathe builders announced reductions within the past week and the milling machine makers are mostly on a lower price level. Some business has been placed, which may be almost directly traced to price reductions. The need for the machines was not so urgent but that prospective buyers could afford to wait for the reductions which they felt were sure to come sooner or later.

The machine-tool trade gets some encouragement from the improvement in the automobile industry. While it is not expected that there will be any early buying of tools by automobile manufacturers, themselves, the resumption of automobile manufacturing on a normal scale will have a decidedly beneficial effect on business sentiment generally and will be the means directly or indirectly of releasing some orders for tools. The Ford plant at Detroit is now turning out 3,000 cars a day, which is about 75 per cent. of its capacity. The Franklin plant at Syracuse, N.Y., is working close to 100 per cent., while the Studebaker, Buick, Dodge, Cadillac, Dort and other plants have shown recent betterment in operations. Automobile parts manufacturers have benefited to a slight extent, though many of the automobile companies are said to have fairly good stocks of finished parts and raw materials.

PITTSBURG EXPECTS CORPORATION TO REVISE ITS PRICES—BUT WHEN?

Special to CANADIAN MACHINERY.

PITTSBURGH, March 31.—About three weeks ago the first signs of an increase in demand for steel products appeared, and the experience now accumulated is that the improvement is of extremely moderate proportions. No one is disappointed, for very little was expected. The only point about the improvement is that the turn has been rounded. Business has not become so good that there is any danger of its going the other way, for it has scarcely any room in which to grow worse.

Since the first of the year the question has been whether there would be a spring buying movement. There was no serious expectation that the turn of the year would bring increased activity, but there is almost invariably an improvement in spring, unless the business has been done in advance. Probably there is now a tendency for business to expand, the tendency being checked by recognition of the fact that steel prices are not yet adjusted to a basis that would likely prove more or less permanent.

There is much discussion of the United States Steel Corporation's attitude on prices and its probable action. The independents, although a couple of months ago they began on a rather broad scale to cut the Steel Corporation or Industrial Board prices, have not even by this time made a definite and stable market. Independent prices went down sharply for two or three weeks and since then they have scarcely been sagging. The level is fairly well defined now, but it is not established by buying. It is chiefly a carload market, with plain indications that on large lots some of the independents would make further concessions, of indefinite amount. Thus there is no established market, and there is no tendency for the market to seek a definite and stable level. In the circumstances it is recognized everywhere that the matter is left for the Steel Corporation to settle. The real market will come when the Steel Corporation acts. It does not follow that the prices the Steel Corporation names will become absolutely the market. Independents may cut those prices slightly, or they may be unwilling to go altogether as low. Or, some may cut the prices and some refuse to meet them. Nevertheless, the Steel Corporation prices will, according to the common view in the trade, represent the market in general, furnishing a schedule in which buyers can have considerable confidence.

The Corporation has not acted and there is no indication as to when it will act. Some men, chiefly outside the trade, have criticized the Corporation for not acting, while many, chiefly within the trade, warmly commend the Corporation's course as being the wise one. Those who criticise the Corporation speak as if business would develop if the reductions were made.

This divergence of opinion arises from confusion between cause and effect. A reduction in prices does not cause people to buy unless they are ready to buy. When people are ready to buy and expect lower prices, failure of prices to decline will cause them to delay buying. The proponents of a price reduction by the Steel Corporation have assumed that price reduction would cause buyers to take hold. Those in the trade are convinced that buyers are not ready yet, and assume that when the Steel Corporation see that buyers are ready it will reduce prices. In other words, a disposition on the part of buyers to take hold must be regarded as a cause for the Steel Corporation to reduce prices, not a result of its doing so. Hence the proper view to take of the present situation is that the Steel Corporation is

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Upright Drills
Horizontal Drills
Gang Drills

Accuracy—Strength
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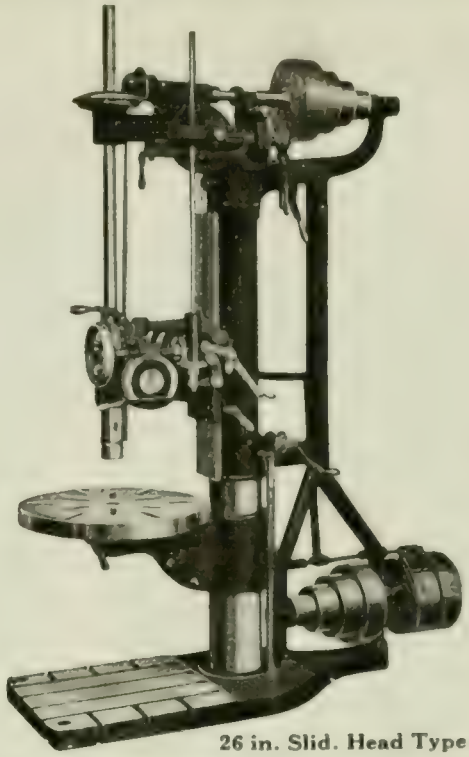

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waiting until buyers are ready to take hold. Then the Corporation will reduce prices and will be glad that the occasion, now being waited for, has arrived. To reduce prices before the buying disposition is developed would be to waste an important psychological influence. Besides, a great many customers of the Corporation do not wish it to reduce prices. They have stocks of raw material and manufactured goods to work off.

Production

Week before last it was estimated that the Steel Corporation was down to a 45 per cent. operation. That estimate, which was quite general, proves to have been incorrect, as the Corporation actually produced steel in the week at 49 per cent. of capacity. Last week, however, it may have gone down to a 45 per cent. rate, as the general tendency of the Corporation's operations is a declining one. The independents have continued to peg along at an average of about 20 per cent., though there are numerous changes in the active list. One mill may close for a week or two while another resumes. Newspaper accounts of mills resuming or closing must not be taken at face, as in some cases the resumptions are emphasized and the stoppages omitted, or vice versa.

Assuming the correct percentages of present operations to be 45 per cent. for the Steel Corporation and 20 per cent. for the independents, the Corporation is producing steel ingots at the rate of 10,000,000 tons a year and the independents at 6,000,000 tons, making 16,000,000 tons altogether, or about 30 per cent. of the total, while the Corporation would be making 62½ per cent. of all the steel. The Corporation has about 43 per cent. of the capacity. In 1919 it made 51 per cent. of the steel and in 1920 about 48 per cent. Its annual report for 1920, just issued, shows that it made 14,532,646 tons of pig iron, 19,277,960 tons of ingots and 14,228,502 tons of steel products for sale. The total steel ingot production of the country may be estimated at between 40,000,000 and 41,000,000 tons, the official figures for 1920 not being compiled as yet.

Prices

Bars, shapes and plates are practically unchanged. For several weeks they have stood at 2c for bars and 2.10c for shapes and plates, in carload lots with desirable specifications. On large lots concessions could be secured, but hardly as large concessions as seemed possible a month ago. Black sheets remain at 3.85c, while galvanized can be done at 4.90c about as readily as they could be done at 5c a fortnight ago. Tin plate remains at $7 as the mill price. The deadlock has not been broken and consumers are buying very sparingly. They can buy at second hand from stocks at between $5 and $6 and they can also buy imported plates, from stock, at about $5, New York, but the loss and expense in cutting down would add to the actual cost and these stocks do not move freely.

Standard steel pipe is now added to the list of steel products on which concessions are obtainable from the Industrial Board or Steel Corporation schedule, making the list complete with the exception of tin plate. Several independent mills will readily give an extra 2½ per cent. discount on standard steel pipe, equal to about $2 a ton, while it seems that in a few cases an extra 5 per cent. has been given.

Pig Iron

Foundry pig iron is now offered at $25, valley, or $1 decline, malleable being also offered at this price. In basic pig iron the market was quotable nominal for several weeks, on an asking price by the merchant furnaces of $25, valley. Now there has been a definite change, in that the steel works, offering pig iron out of stocks they were awkward enough to accumulate as they were slowing down their operations, will sell at $23, and a few small sales have been effected. The merchant furnaces have decided not to follow the market, but to stand aside until the steel works have disposed of their accumulations. The $23 price is below the merchant furnace cost, and may even be a shade below the cost of replacement by steel works without counting overhead, but the steel works see an advantage in selling out of these stocks, because when they need pig iron they can make it and use molten iron in steel making, saving the cost of remelting.

GRATITUDE IS THE EXPECTATION OF FAVORS THAT ARE STILL TO COME

HE wasn't in a particularly good mood about the thing when we called the other morning, and before anything was done he talked, and using the proper and well recognized way of doing things, we record what he said:

"Well can you beat that?"

"Beat what?"

"Well, not so very many weeks ago a couple of chaps came in here, and wanted us to start them up in business. They had both of them had considerable experience in the woodworking business, and seemed to be anxious to get to work and do something. They secured a contract for making up some cheap furniture, enough to keep them busy for the next few months, and it was on top of this contract that they wanted us to stake them to the plant. We went into the matter carefully, and in order to give them a start, we decided to go ahead.

"I can tell you this, that no person ever got so much equipment out of this place on such a small payment. Well, to cut down on the in-between stuff, they got started, and have been going along pretty fair ever since, and have picked up a couple of other little lines that can be done on their same equipment. Well, they wanted some little thing the other day, and one of them came in here to find out what it was worth. He wasn't looking for a plant any more. He was a full-fledged mill owner.

"I told him what it would be worth to put it in, and about how long he would have to wait, when he broke in with, 'Never mind about that. We don't think we'll buy anything more here. You've been getting enough of our business for a while.'

"It took me quite a little while to get enough wind to remark that it might be good policy for us to collect for what we had sold before letting them have anything more,—but what's the use? The chances are that man will get along."

NO BRIGHT SKY IN WASTE METALS

Dealers Declare That Even Lowly Price Schedule Fails to Move Material

There has been nothing come to the surface yet that would make the scrap metal trade look any better. If such a thing were possible, the tendency is still to shove prices down to a lower level. A glance at the schedule would show anyone that the figures will go up as soon as there is anything in the line of a demand for material, for until the demand comes prices stay in the cellar.

"For all intents and purposes we are out of the market," stated one of the largest dealers this morning. "Even at the figures you are quoting it is doubtful if we would take on anything at all, unless we could see where we were going to dispose of it almost at once."

Yards state that neither the steel mills nor the foundries, which are their largest buyers, are taking on anything.

The whole waste material trade is depressed the same as the metal end of the business.

GOOD NEWS FOR THE RAIL MILLS

Work On Extending The T. & N. O. Will Be Gone On With This Season

Cochrane.—George W. Lee, chairman of the T. & N. O. Railway Commission, made the statement here that the surveys in connection with plans to extend the railway north from Cochrane toward James Bay will be gone ahead with immediately. It is planned to complete all surveying so as to proceed with the first 70 miles of the extension about next fall.

Among other things, the line will touch Kettle Falls on the Abitibi River, where a large hydro-electric plant may be installed for the purpose of operating pulp and paper mills, as well as providing power for the electrification of the T. & N. O. Railway.

Cochrane business men are enthusiastic about the contemplated development and the extension of the railway, and the present step is believed to be ultimately designed with the object in view of finally continuing right on to tidewater at James Bay.

Pig Iron Market

Pig iron has been further reduced during the week. More blast furnaces are going out and the Steel Corporation's curtailment of pig iron output has been rather rapid. The appearance of three definite inquiries for round lots of the steel-making grades on the Pittsburgh market has developed a competitive market between merchant and steel plant offerings. A merchant producer with furnaces in the Valley reports a sale of 1,000 tons for immediate delivery at $25, but against this is one of a similar quantity to a Valley steel maker from one of the Valley steel plants at a price of $23 furnaces, while the Allegheny Steel Co., which has an inquiry out for 1,000 tons each of basic and Bessemer, is said to have been quoted $23 and $25 respectively on these grades. Practically nothing has been done in the past week in foundry iron, and the price has become nominal.

The only large inquiry before the trade at Chicago is that of a Wisconsin melter who recently bought two 2,000-ton lots of Northern foundry at $26 delivered. The American Radiator Co. has bought 300 tons of Southern foundry 2.25 to 2.75 per cent. silicon at $25 base Birmingham for its Detroit plant.

A slight improvement is noticed in the demand for foundry iron for prompt shipment on the Cleveland market. With the exception of one small lot of malleable iron, all the sales were in foundry iron. A local producer has reduced its price $1 a ton to $26 for No. 2 foundry for outside shipment.

Buffalo reports that a local furnace has been approached from two sources and asked to name a price on a large tonnage of pig iron unquestionably for speculative purposes. From this it is believed that certain speculators believe that the bottom has been reached and that it is a good time to buy. Sales are no better.

Scrap Metal Market

There has been a sharp decline in prices during the past week. Trading is practically at a standstill and some large declines are being forced.

Philadelphia reports that iron and steel scrap is now selling at prices netting the sellers more of a loss than at any time in history. Several hundred tons of heavy melting steel scrap were sold last week at $12.75 delivered, and several small sales were reported on other grades.

The absence of buying on the New York market is bringing further declines in practically all materials with the exception of cast material. The declines range from 50 cents to $1.50.

On the Pittsburgh market buyers will not take tonnage except at prices so ridiculously low that they become unattractive to dealers. The Pennsylvania railroad recently sold some steel axles a little above $18 and hence this grade has dropped from $22 and $23 to $18 and $19.

The scrap market has found a new level at Buffalo with heavy melting steel at $11.50. One buyer in this district is offering no more than $10 and insisting on No. 1 grade with strict inspection, but not much selling is being done at this figure. There is a little business being done in stove plate, about 500 tons being sold in small lots at $19.

Dealing has been almost wholly lacking at Cleveland, and the quotations that were regarded as bottom are now discarded. Reductions have been made all along the line with the exception of one or two grades.

There is a little keener demand, and heavy melting steel is slightly higher on the Detroit scrap market. The market in other lines is dull. Conditions are brightening in the Detroit automobile plants and dealers are looking for better conditions to result in scrap.

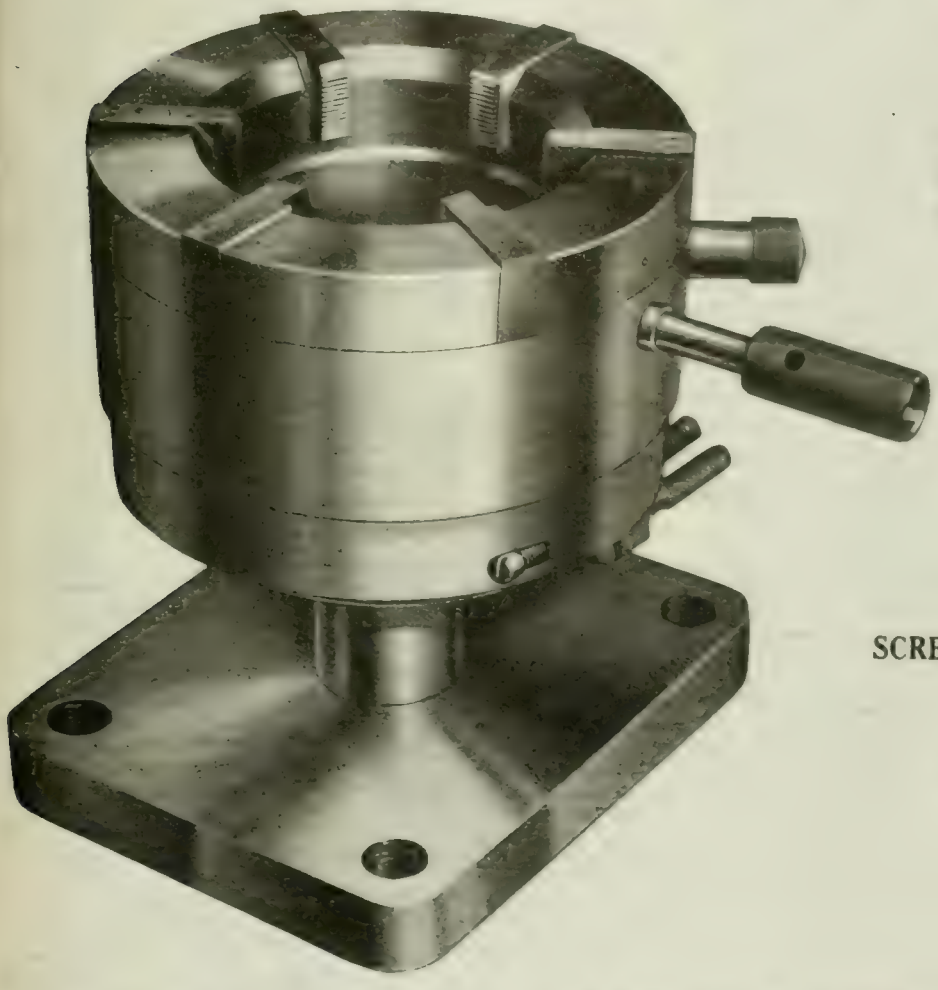
GEO MET RIC

Right in the Lead

— IT'S A STAR —

This Was the Reply of a Production Manager When Asked How He Liked

THE GEOMETRIC DIE HEAD



The Geometric Die Head illustrated is flanged for bolting to the Turret Face.

GEOMETRIC
SCREW THREAD CUTTING TOOLS
ORIGINATE
AND
SET THE STANDARD

Geometric Automatic Die Heads and Collapsing Taps are furnished in several types so as to best adapt them to the Turrets of Hand and Automatic Screw Machines.

The usual requirement is for a Tool that is held stationary and the work rotated, but if a Rotary Die Head or Collapsing Tap is needed, a Geometric of just the right construction is available.

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Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$26 00
Lake Superior, charcoal, Chicago	40 50
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	28 96
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	39 25

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 25
Steel bars, base, Toronto	4 25
Iron bars, base, Montreal	4 25
Steel bars, base, Montreal	4 25
Reinforcing bars, base	4 25
Steel hoops	5 50
Tire steel	5 00
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	4 75
Chequered floor plate 3-16 and heavier	6 50
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	2 10-2 25
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 9 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$18 00	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	37 00	40 00
Spelter	7 75	7 50
Lead	6 50	7 50
Antimony	8 00	8 25
Aluminum	34 50	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$5 25	$4 75
Plates, ¼ up	4 75	4 25

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk.	Galv.	Blk.	Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	27 84
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk.	Galv.	Blk.	Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 9 50	$ 9 00
Copper, crucible	11 50	11 00
Copper, heavy	11 00	11 00
Copper wire	11 00	11 00
No. 1 machine composition	10 00	9 75
New brass cuttings	7 00	8 00
Red brass turnings	8 00	8 00
Yellow brass turnings	6 00	6 00
Light brass	5 00	5 00
Medium brass	6 00	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 50	4 00
Tea lead	2 00	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$11 00	$12 00
Heavy melting steel	15 00	14 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	15 00	14 00
Malleable scrap	20 00	20 00
No. 1 machine cast iron	30 00	25 00
Pipe, wrought	8 50	8 00
Car wheel	30 00	25 00
Steel axles	20 00	18 00
Mach. shop turnings	8 00	6 00
Stove plate	23 00	20 00
Cast boring	5 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	47 00
Forging billets	48 50
Wire rods	57 00

NAILS AND SPIKES

Wire nails, base	$5 10
Cut nails, base	5 75
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

ATKINS
METAL CUTTING SAWS

MISCELLANEOUS

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	40 and 5
Can. carbon cutters, plus	10
Standard drills, all sizes	40 and 5
3-fluted drills, plus	10
Jobbers' and letter sizes	40 and 5
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Gasoline, per gal., bulk	0 42
Chucking reamers	Net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 6 50	$ 6 50
Sheets, blue ann., No. 10	5 50	5 50
Canada plates, dull, 52 sheets	12 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz., galvanized	....	.....
Queen's Head, 28 B.W.G.	10 75	.....
Fleur-de-Lis, 28 B.W.G.	10 00	.....
Gorbal's Best, No. 28	....	.....
Colborne Crown, No. 28.	....	.....
Premier, No. 28, U.S.	8 75	8 50
Premier, 10¾-oz.	8 25	8 90
Zinc sheets	13 00	15 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	29 50
1¾ in.	29 75	27 00
2 in.	29 25	24 50
2¼ in.	33 00	28 50
2½ in.	44 75	32 50
3 in.	49 25	40 00
3¼ in.	.....	48 50
3½ in.	63 50	43 50
4 in.	85 00	55 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	21	Atlas	19
Peerless	22	X Empire	15
Grand	21½	Ideal	18
Superior	21½	X Press	13½
X L C R	16½		

WASTE

Colored

Lion	13½	Popular	10½
Standard	12	Keen	9
No. 1	14		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	20	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard	10%	Best grades	15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$30 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	32 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	38 00	42 00
Copper sheet, planished, 16 oz. base	44 00	48 00
Braziers', in sheets, 6 x 4 base	36 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

MORROW DRILLS

Made from Hammered Steel Bars

They are made of English Sheffield steel, Morrow tempered, with a web of graduated thickness. They possess strength where strength is needed and give *more holes* with *less regrinding.*

Oldest, largest and best equipped plant in the Dominion, manufacturing Set Screws, Cap Screws, Engine Studs and Semi-Finished Nuts.

Sole distributors of P-H and IMPERIAL FILES.

Please Note Our New Montreal Office:

JOHN MORROW SCREW & NUT CO. LTD.
489 St. Paul Street West, MONTREAL, QUE.
Telephone: Main 8418.

WORKS AT

INGERSOLL

If interested tear out this page and place with letters to be answered.

Engineering

A garage is contemplated by John O'Grady, 84 Osgoode Street, Ottawa, Ont.

The Three Hills Milling Co., Three Hills, Alta., are planning to erect a flour mill at cost of $30,000.

A warehouse will be erected by Irving Wood & Co., 2907 Dundas Street West, Toronto, at a cost of $20,000.

Black and Irish, 606 Merchants Bank Building, Winnipeg, Man., are contemplating the erection of a garage.

Plans for alterations to the Kay Building, Toronto, Ont., are being prepared by F. H. Maranit, architect, Manning Chambers.

The Butterfly Hosiery Co., Drummondville, Que., contemplate the erection of an extension to factory at a cost of $300,000.

A plumbing shop and public hall are being built by H. Massicotte & Freres, Inc., Cap de la Madeleine, Que., at a cost of $10,000.

The Royal Brush Co., Hamilton, Ont., is asking for a small second-hand planer, 16 or 18-inch, with long bed; also cut off and rip saw.

The National Castings, Ltd., Belleville, Ont., will start work in the near future on the erection of a foundry and other additions.

Royal Drug Exchange, 51 St. Joseph Street, Quebec, Que., has purchased the building and will transform it into a large pharmaceutical warehouse.

The Mimico-New Toronto Joint Sewage Commission, Mimico, Ont., will purchase pumps of 2,000 and 1,500 gallons per minute capacity for a pumping station.

The Supercharge Engine Co. of Canada, Ltd., 120 St. James Street, Montreal, will receive bids for the erection of a plant and will purchase the necessary equipment.

The Temiskaming & Northern Ontari Railway Commission, 56 Church Street, Toronto, will build shops and engine houses to cost about $80,000 and will spend $57,500 on equipment.

The contract for the erection of office and brass foundry for the Taylor & Arnold Engraving Co., 260 St. James Street, Montreal, has been awarded to W. H. Madigan, 949 Atwater Avenue.

The Engineering & Machine Works of Canada, Ltd., St. Catharines, Ont., desires a high embossing type press for making ½-inch letters and figures for numbering wood patterns.

The machine shop, boiler house and forge of the Nova Scotia Steel & Coal Co.'s shipbuilding plant at Trenton, N.S., recently destroyed by fire with a loss of $60,000, will be rebuilt at once and new equipment purchased.

The Gove Motor Co., Tilbury, Ont., will start work about April 1 on the erection of factory to manufacture automobiles and trucks and will be in the market for metal-working machinery and special equipment.

The Dods Knitting Co. will build an addition to their factory in Orangeville, giving them an additional 20,000 feet of floor space.

Construction will begin next month on the new pulp and paper mill at Kenora, Ont., for E. W. Backus, of International Falls, Minn. Five hundred men will be employed on construction work.

Thos. Sharpe, Avenue Block, Winnipeg, Man., has been awarded the contract for erection of a garage at cost of $80,000 for Consolidated Motors, Ltd., corner Portage Avenue and Victoria Street.

Enlarging Plant.—The Peterborough Gas Works are building an extension to their plant, which will, when completed, give double the capacity of the present purifiers. The Economic Gas Construction Co., of Toronto, have secured the contract for this work.

Wants Equipment.—A correspondent wishes to know who can supply him with a machine for making buggy and perambulator wheels, these to range from 4 inches to 18 inches diameter. He also asks, "Who can supply the material for these wheels; ribs, spokes, and rubber cushions?" Any firm interested in this request can secure further information by writing the editor of Canadian Machinery.

Looks for Good Year.—Fred Armstrong, president of the Port Hope Sanitary Manufacturing Co., reiterated his belief at the annual meeting that the present year would witness a large volume of building throughout Canada. He, however, emphasized the importance of amicable relations between employer and employee. Only routine business was transacted at the meeting, and the former directors were re-elected as follows: L. M. Wood, R. J. Cluff, W. D. Ross, Fred Armstrong, M. L. Davies, Robert Fleming and W. J. Cluff.

Going to Start.—Speaking to a representative of this paper, James Hamilton, managing director of the Peter Hamilton Co., Peterboro, engaged in foundry and machine shop work, stated that the foundry end of the business, employing about twenty men, which has been closed for a month due to lack of orders, will reopen in the course of the next few days. Mr. Hamilton believed that the general slump, under which business has been laboring for the past few months, is due for a break, and he is quite hopeful that the coming season will be a good one for business in general.

Personal

T. A. Hollinrake, president and general manager of the A. R. Williams Machinery Co., has been spending the last couple of weeks at Atlantic City.

Willys-Overland, Limited, are announcing an appointment of special interest in automobile circles, in the selection of H. E. Brasier as manager of the Toronto Branch, succeeding H. D. Scully, who has resigned to take up other important work. Mr. Brasier has been service manager for Canada for some years, and is widely known throughout the whole Canadian Overland organization. He will have a field for which he is particularly adapted owing to his large acquaintance in the city. He was connected with the bicycle industry first, and later joined the Russell Motor Car Co., where he was for several years accountant at the Toronto Branch. When this company was taken over by the Willys-Overland, Ltd., his good work led to his appointment as service manager at the head office.

Montreal Notes

The Lyman Tube and Supply Company have been appointed Canadian distributors for the "Hoffman" ball and roller bearings, manufactured by the Hoffman Manufacturing Company of Chelmsford, Essex, England.

* * *

Roderick McLean, engineer, 128 Bleury St., Montreal, has secured the Canadian agency for the Cleworth, Wheal and Company, of Castleton, England, manufacturers of air filters, humidifiers and water coolers.

* * *

R. Percy Sims, consulting engineer, of Montreal, is moving his office from 424 Philips Place to more commodious offices at 358 Beaver Hall Hill. This firm has the contract for the refrigerating plant of the new cold storage warehouse being erected for the Montreal Harbor Commissioners.

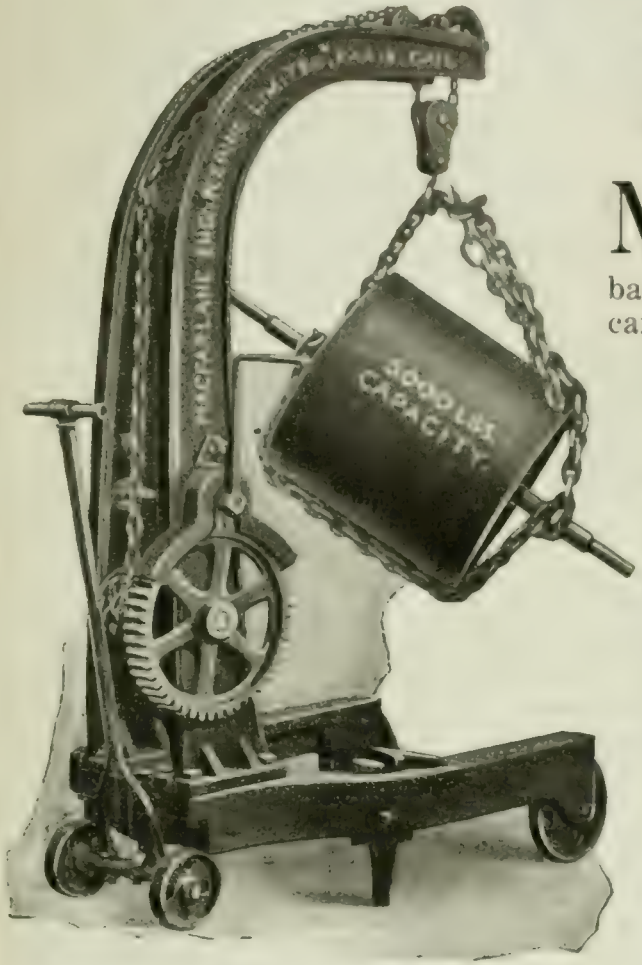
* * *

Both the Angus shops of the C.P.R. and the Point St. Charles shops of the Grand Trunk have been closed down for a period of about ten days owing to the lack of work in the way of locomotive repairs. It is expected that some proposition will be made to the men in the near future regarding a revision of the working schedule and the rates of wages.

* * *

The engineering firm of G. and J. Weir, of Montreal, have added a new department to their business. This section will take care of the repairing of vessels plying to and from the port of Montreal, and a thoroughly experienced staff of workmen and an efficient superintendent from the parent plant will look after this division of the work. Work on the new foundry of this firm has been started, and it is expected that the plant will be in operation before the middle of the summer. This firm has considerable work booked ahead, and full time operation is looked for throughout the season.

MacFARLANE Portable Floor Crane



The Biggest Labor-Saver in the Plant

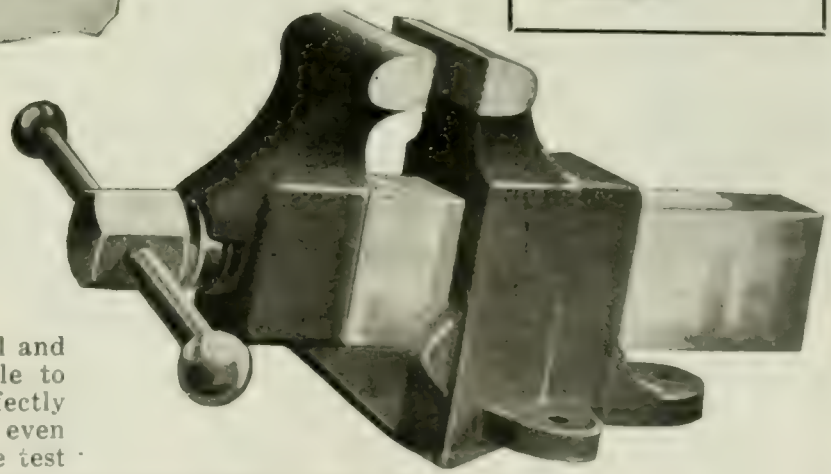
MACFARLANE Portable Floor Crane and Hoist has a capacity 2 to 6,000 lbs. Cut illustrates the industrial types with high base and large wheels; it is easy moving and can be operated by one man at full capacity. Equipped with Hyatt Roller Bearings.

THE LARGEST TYPE OF HOIST is similar except for base casting, which is lower, to allow machine being placed under axles of car and in such places where little height from floor is experienced.

MADE - IN - CANADA AND MADE BETTER

The MacFARLANE LINE

Portable Floor Hoists and Cranes.
Machinists' Vises of all types.
Trolley Wheels.
Oilless Bushings.
Heavy Duty Winches.
Grey Iron Bronze and Aluminum Castings.



MacFARLANE *Quality Vise*

Machinists' Vise — a solid, sturdy tool; the main casting is entirely of semi-steel and jaws of high carbon steel fused in place. Balls are of steel and so arranged that it is impossible to remove them. The teeth are perfectly milled and possess a perfect, even grip. All vises undergo a severe test before leaving the factory; thus we can unqualifiedly stand behind them.

We manufacture all types of vises, including the quick-acting vise.

FULL INFORMATION PROMPTLY GIVEN

G. W. MacFARLANE ENGINEERING, LIMITED

PARIS, CANADA

If interested tear out this page and place with letters to be answered

THE "FLU" Stayed out of this PLANT

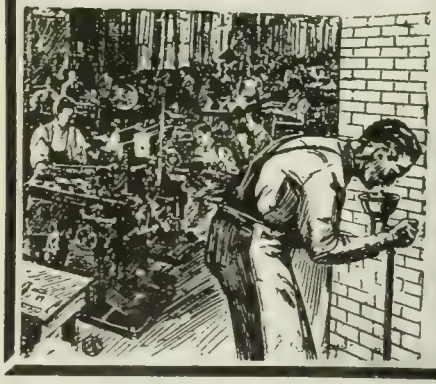
PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

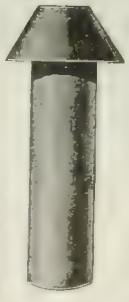
The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.

888 F. St. Andre St., Montreal, P.Q., Canada



BOLTS AND RIVETS



We are equipped to fill the requirements of the Marine trade promptly. Square head, hexagon head and all kinds of Machine, Deck, Carriage Bolts and Rivets.

QUALITY PRODUCTS

LONDON BOLT & HINGE WORKS

LONDON, CANADA

U. S. AUTO PLANTS READY TO PUT PRODUCTION AT CAPACITY

Detroit.—One hundred per cent. production schedules will be put into effect in practically every automobile plant in Detroit, beginning next Monday, it was learned in a canvass of the factories.

Manufacturers are optimistic over the future of the industry. Almost every plant reported orders coming in rapidly. Men are being hired every day, and departments are being built up to a normal basis.

The Paige Detroit Motor Car Company will resume full time production Monday.

Officials of the Hupp Motor Car Co. said that production will be increased to normal next Monday.

Increase 50 Per Cent.

Production in the Hudson and Essex plants will be 50 per cent. greater in April than it was during March, an official stated. The company acknowledged that it has more orders on its books at present than it can fill in the next 60 days.

All plants of the Studebaker Corporation, which have been running on a five-day-week basis, will be operated six days the first week in April.

During April production in the Packard plant will be 50 per cent. greater than it was during the last three months. In May it will be increased to 100 per cent. more than during January, February and March.

Open New Plant

The new plant of the King Motor Co. will be opened next week.

The Maxwell Co. will increase production to a 45 per cent. basis next week.

Production in the plant of the Chalmers Motor Car Co. will be 75 per cent. greater during April than in March, said one official.

Officials at other plants, although admitting that production will be increased April 1, refused to give actual figures.

The Ford Motor Car Co. has received orders for 90,000 cars to be delivered in April, as against about 80,000 in March.

OSHAWA PLANTS WELL UNDER WAY

Operations There Have Been On The Increase and Unemployment Has Almost Ceased

According to an Oshawa man, conditions in the automobile plants in that town are constantly improving, and the McLaughlin, Chevrolet and Oldsmobile shops are all running. The rate of production, of course, is not up to normal, but it is increasing. "I have no definite figures," said our informant, "but I should say that around 60 per cent. at least would be their present rate of operation."

"Another thing that we can judge by," he said, "is the unemployment, which has practically ceased. Some of the men who were skilled in certain lines of work in the auto shops who were let out some months ago have been brought back to work, and some time ago all the married men had been given their places back. Fittings Limited is also working on a fairly good basis, and they must have about 80 per cent. of their normal staff at work now. Indications are that things are moving along in a much better way than they were a few months ago, and there is a feeling that business is very much on the mend."

RECENT CHANGES MADE IN PRICES

Some of the Firms That Have Announced Reductions in Their Schedules

Reductions of about 15 per cent. on Kearney & Trecker, Kempsmith and Hendey milling machines are reported. Cincinnati and Brown & Sharpe were reduced some weeks ago. The Canedy-Otto Mfg. Co. has reduced prices about 15 per cent. on its line of radial and upright drills, forges, grinders, etc. The Champion Blower & Forge Co. has announced reductions approximating 10 per cent. and the Royersford Foundry & Machine Co. has cut 10 per cent. on its punching and shearing machines and sensitive drills. Reductions on some lines of lathes are also reported and a Western maker of vertical boring machines has reduced prices about 20 per cent.

EXTEND PLANT AT FORT WILLIAM

Canada Iron Foundries May Make Extensions and Go in for Wheel Making

The location of a wheel-making plant to cost $150,000 as a subsidiary of its present plant in Fort William is in contemplation by the Canada Iron Foundries. Major Hughes and C. J. Jobb, of the Montreal offices of the company, met the mayor and aldermen of Fort William regarding the proposed new unit. The aldermen noted that the company's fixed tax assessment expires this year. In requesting a renewal the members of the company pointed out that the company is prepared to go ahead with the building of the wheel-making plant when the council is ready to submit a proposition setting out what the city is willing to do.

In 1920 the company paid out in wages at its Fort William plant over $260,000.

ALGOMA WANTS TO GET BUSINESS

Steel Mill Needs Orders for Rails — Many Men Out by Shut-Down of the Mills

Sault Ste. Marie, Ont.—A deputation comprising Mayor Thomas Farquhar, President J. A. Hussey of the Board of Trade, and A. E. Whiteal, president of the Trades and Labor Council of this city, went to Ottawa to wait on the Government to ascertain if something cannot be done toward getting orders for the Algoma Steel plant, which let out a great number of its employees for lack of orders for steel rails. It is estimated that nearly 2,000 men have been walking the streets here out of employment, and that unless orders come in to the Steel Corporation the prospects for the coming summer will not be very bright for the men.

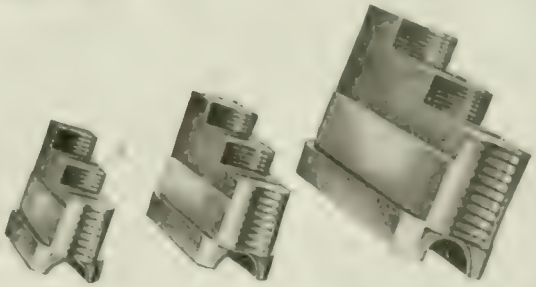
PIG IRON PRODUCTION

The 1920 pig iron production of the United States was 36,925,987 tons as compared with 31,015,304 tons the preceding year, according to official statistics of the American Iron & Steel Institute, just announced.

Output in 1918 was 39,054,644 tons and in 1917, 38,621,216 tons. Production of 39,437,797 tons in 1916 was largest in history of the industry. Largest production in any pre-war year was in 1913 when output reached 30,966,152 tons.

DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



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THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

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Engineers • Manufacturers
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3

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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WANTED — ONE USED WATER CINDER mill. State length of time machine has been used, condition and where it can be examined. State lowest net price. G. W. McFarlane Engineering Limited, Paris, Ont.

WANTED—NEW AND RE-MANUFACTURED gas and gasoline engines, boilers, saw-mill machinery, planing mill and sash and door factory machinery. New and manufactured iron and wood-working machinery. Electric motors, dynamos, direct connected steam operated generators, portable electric tools. Builders' hoists, elevators. Box 739F, Canadian Machinery.

IF YOU HAVE IRON-WORKING OR WOODworking machines for sale, or idle machine shop equipment, call or write Canada's largest dealers in new and used machinery. H. W. Petrie Limited, Toronto, Ont. (cfm)

ONE SINGLE STAND 9 x 18 ROLL IN GOOD condition; one receiving separator, capacity about 1,000 bushels per hour. Crane Bros., 817 Ferry St., Niagara Falls, Ont.

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Turret Lathe and Automatic Screw Machine a Specialty. Let us quote on your work.
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FOR SALE—100 PACKAGES OF 225 SHEETS each Prime Coke Tin Plates, 55-lb. or 38 gauge, immediate delivery. Inquire Newell Manufacturing Company, Prescott, Ont.

THREE 50 H.P. TYPE C.C.L., TWO 50 H.P. type H.S.; Westinghouse motors, one 30 h.p., and one 32 h.p. and one 40 h.p. Chapman-Walker motor; twenty 16 in. Bliss turret lathes and eleven No. 2 Foster turret lathes, nine No. 3 Foster turret lathes, two 14 in. Warner & Swasey lathes, two No. 6 Warner & Swasey lathes, one No. D1 Colburn drill press, eleven No. 1 Burke hand millers, and one 68N Bliss press and one 57½ Toledo press, one hydraulic accumulator, two No. 55 National Acme automatics; also various other lathes, millers, pumps, hardness testing machines, etc. Apply Box 760F, Canadian Machinery.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
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REGO WELDING *and* **CUTTING APPARATUS**

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co. of Toronto, Limited
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Phones: Adelaide 2841 and 1524 (TF)

POSITIONS WANTED

POSITION WANTED—MACHINE SHOP SUperintendent or general foreman. Acquainted with modern machine shop practice and heat-treatment of steel. Thirty years' experience. Production or contract work. Box 757, Canadian Machinery.

AGENTS WANTED

AMERICAN FIRM, SPECIALIZING IN OXYacetylene welding and cutting equipment, is desirous of securing representatives and agents in Canada. Apply Box 763F, Canadian Machinery.

HELP WANTED

MECHANICAL ENGINEER — WE REQUIRE the services of a mechanical engineer competent to supervise the manufacture of patent automatic machinery and the installing of plant; big position to good man. State particulars to Box 764F, Canadian Machinery.

WANTED—A MAN TO TAKE CHARGE OF A steel range department in a foundry in Ontario; one accustomed to welders preferred; good wages and steady employment to the right man. Apply Box 765F, Canadian Machinery.

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

MACHINE WORK WANTED

We are equipped to handle all kinds of general or special machine work. All operations in our plant are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT
Builders of Reliable Machinery.

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Will handle medium Specialty Line — Manufacturing and Selling

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- Tiger High Pressure Piston Packing
- Flax Packings
- Asbestos Gaskets
- Asbestos Tape

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Then it will pay you to watch this advertisement from week to week, as we specialize in all kinds of iron and woodworking machinery, together with a full line of contractors' and mining equipment.

Send us a list of your requirements and we will convince you that our prices are right.

We are open to buy
MILLING MACHINES AND SHAPERS.

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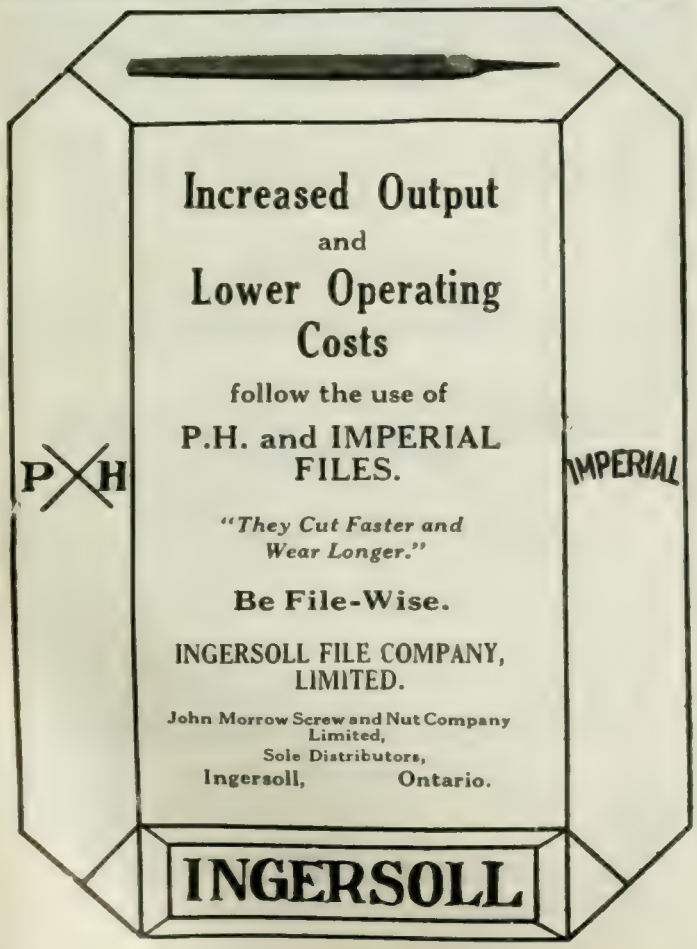

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CO., LIMITED
237 Dufferin St., TORONTO, Canada

GARLOCK-WALKER LIST

If You Want Machine Equipment, Send Us Your Enquiries

We have one of the largest stocks of new and used metal and woodworking machines in Canada.
Many machines only very slightly used and all absolutely guaranteed.
A few machines from our Toronto stock at exceptionally attractive prices are:

LATHES

1—30″ x 12′ "Blaisdell" (used).
1—30″ x 14′ "Niles-Bement-Pond" (used).
1 26″ x 14′ "Niles-Bement-Pond" (used).
1 24″ x 10′ "Milwaukee" (new).
1—18″ x 8′ "Rae" (new).
1—16″ x 6′ "Reed" (used).
1 12″ x 8′ "LeBlond" Tool Room (used).
1—8″ "Rivett" Cabinet Type, full attachments (used).
1 7″ "Cataract" Precision (new).

GAP LATHES

1—38″ x 54″ x 12′ Bertram (used).
1—22″ x 40″ x 16′ McDougall (used).
1—21″ x 30″ x 7′ South Bend (used).
1—20″ x 38″ x 12′ C.M.C. (used).

TURRET LATHES

No. 4 Millhollands, capacity 1⅝″ (used).
Several Davis Turrets and other makes. Various capacities.

SHAPERS

1 -16″ "MacKenzie" B.G. Crank Shaper, (new).
1—16″ "Rae" B.G. Crank Shaper (slightly used).
1—24″ "McGregor-Gurley" B.G. Crank Shaper (used).

PLANERS

1 42″ x 42″ x 20′ Putnam, 1 head (used).
1 30″ x 30″ x 10′ Pond, 1 head (used).
1—24″ x 24″ x 6′ Powell, 1 head (new).

MILLING MACHINES

1—Briggs High Duty Type "A" 22″ Traverse (new).
1—Briggs High Duty Type "B" 42″ Traverse (new).
1—Whitney Hand Miller, 18″ x 6″ table (used).
1—No. 3 Ford-Smith Plain (used).
1—No. 3 Ford-Smith Universal (used).
1—No. 4 Cincinnati Plain (used).

DRILLS

2—10″ Burke Sensitive (Bench type) (new)
1—15″ Barnes (used).
20″ "Sibley," "Champions," "Rockwell" and "Silver" (new) and (used).
1—36″ C.M.C. Heavy Duty (used).
1—3-spindle 20″ Silver Gang Drill (used).
1—4-spindle W. & R. Sensitive (used).

BORING MACHINES

1—66″ Bement-Niles Vertical, 2 heads, 24″ under rail (used).
1—Universal No. 2½ Horizontal Table, 42″ x 22″ (used).
1 Bullard "New Era" Vertical Turret, 36″, complete equipment (new).

POWER HACK SAWS

1 No. 10 Racine 8″ x 8″ Cap. (new).
1—No. 7 Watkins 9″ Cap., 18″ Blade (used).
1—6″ x 6″ Racine (used).

AIR COMPRESSORS

1—12″ x 12″ Bury, Class "L," Belt driven (used).
1—8″ x 8″ Sullivan, Class W.G.-3, Belt driven (used).
1—8 x 10 x 8 Bury, Steam driven (used).

GRINDING MACHINES

1—Landis No. 4 Universal (used).
1—Landis Plain, self-contained, 36″ x 12″ (used).
1—Norton Plain, No. 434 (used).
1—Fitchburg Cylindrical 8″ x 36″ (new).
Several Tool and Cutter Grinders (new) and (used). "Globe," "Stevens," "LeBlond" and "Cincinnati."

MISCELLANEOUS

2—No. 4 Jno. Hall Pipe Machines (1 used) (1 new).
1—Lennox Rotary Bevel Shear, 1″ Cap. (new).
1—"High Speed" Hammer, No. 3A (used).
1—Beaudry Champion Power Hammer, No. 9 (used).
1—"Grant" Riveting Machine, No. 80A (used).
1—"Grant" Riveting Machine, No. 80B (new).
1 Arbor Press, No. 4 "Greenerd" (new).

GARLOCK-WALKER MACHINERY CO, LIMITED

MONTREAL, 337 St. James St. TORONTO, 32 Front St. W. WINNIPEG, 567 Banning Ave.
Warehouse: 163 Dufferin Street, Toronto

This is a Canadian-Made Planer. Standard size 42″ x 42″ x 10′ 0″. For general dependability use a Hepburn. It pays.

HEPBURN

HIGH-SPEED PLANER

The material in this Hepburn Planer is of the best, and the workmanship equal to any other. Thus long service is assured.

Two or four heads supplied as required. The rack is of cast steel and the pinions are made solid with the shafts. Write for specifications.

We also manufacture Power Presses, Cranes, Pumps, Engines, Cut Gears and Grey Iron Castings.

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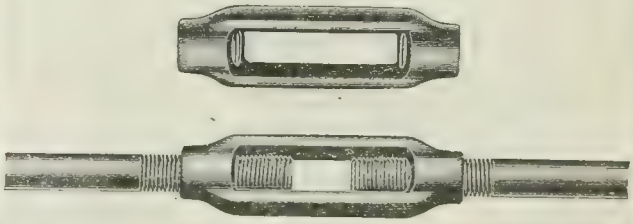

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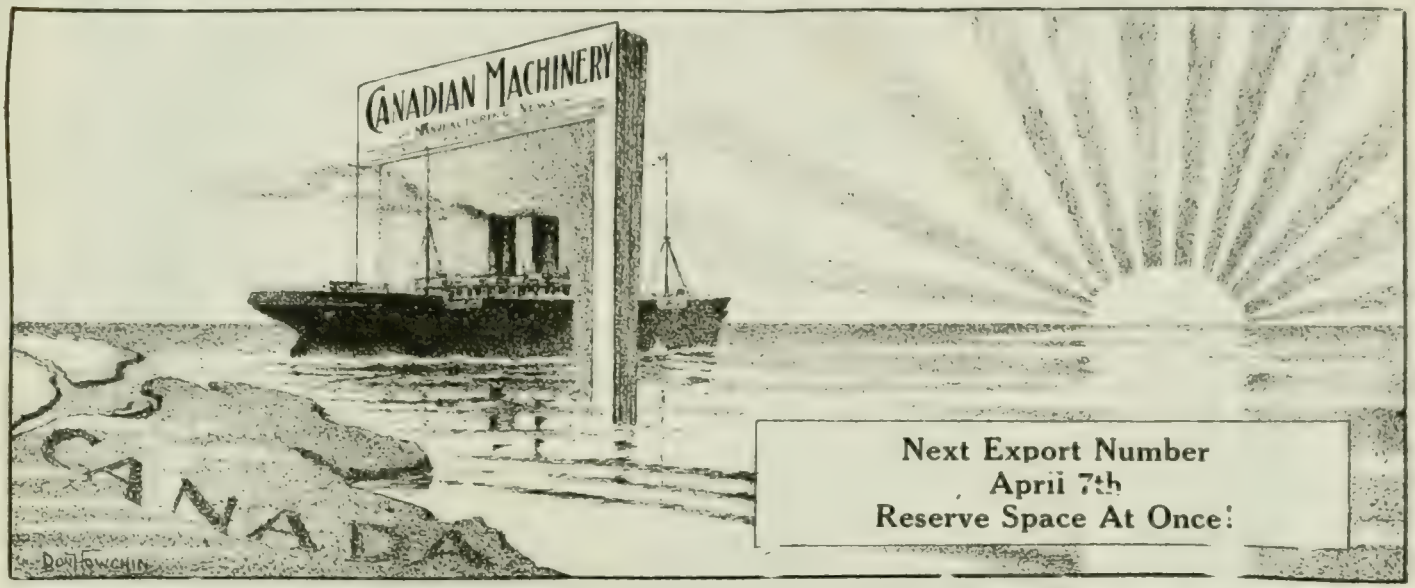

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Heavy Duty Draw Cut Shapers, Special Heavy Duty Draw Cut R.R. Shapers, Special Locomotive Cylinder Planers, Traveling Head Planers, Special Roll Wobble Planers, Portable Planers, Stationary and Portable Keyway Cutters, Finished Machine Keys. See our full page advertisement in the first issue each month of "Canadian Machinery."

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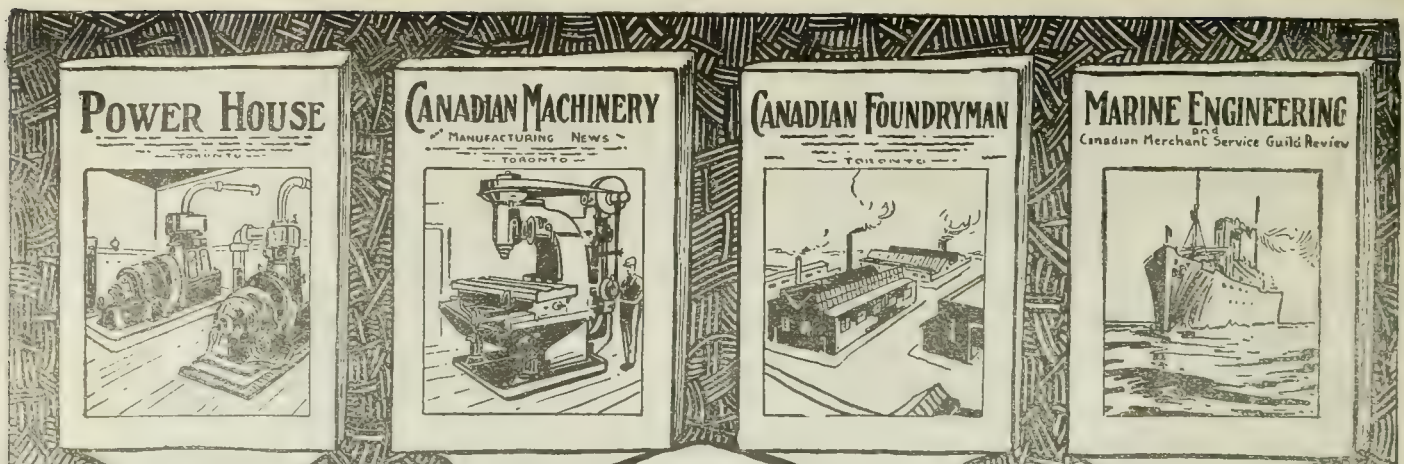

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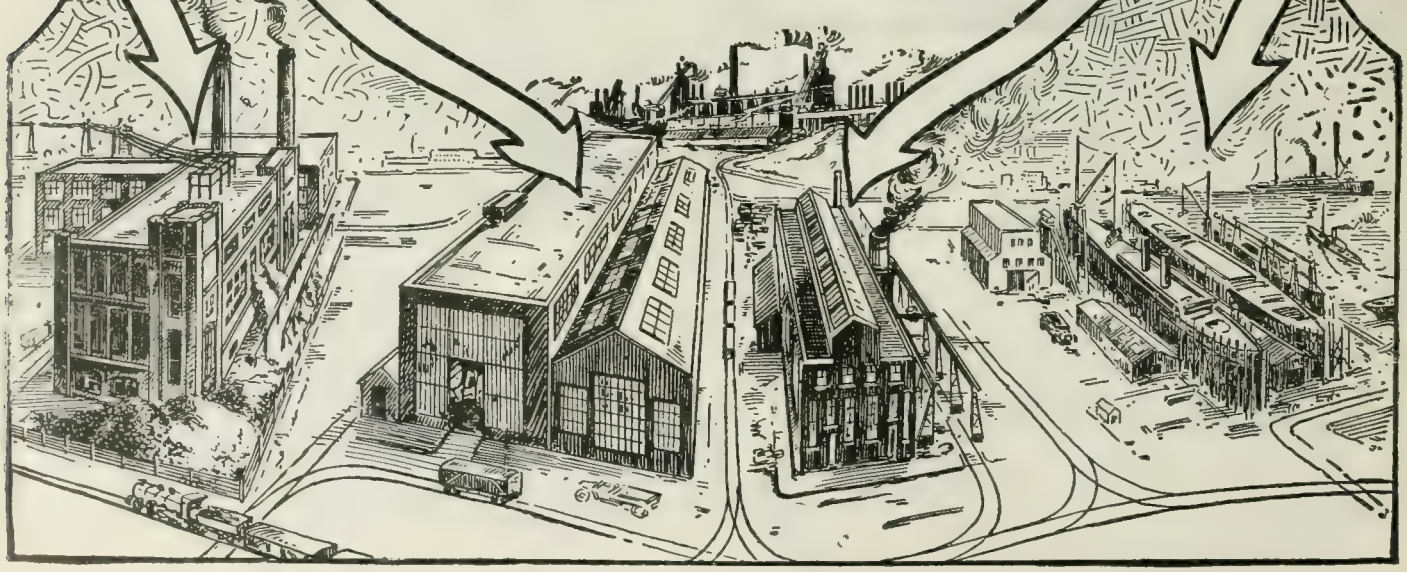

Rates and Information Effective Jan. 1st, 1920. All previous rates cancelled.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

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Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

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Toronto Testing Laboratory, Toronto, Ont.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Columbia Hdwe. Division, Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Dom. Foundries & Steel, Hamilton, Ont.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
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Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

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Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
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Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
[illegible]
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
[illegible]
Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
[illegible]
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
[illegible]
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
[illegible]
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
[illegible]

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
[illegible]
Gisholt Machine Co., Madison, Wis.
[illegible]

Boring, Drilling and Milling Machines, Horizontal
[illegible]
Dundas, Ont.
[illegible]
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
[illegible]

Boring, Drilling and Milling Mach., Vertical
[illegible]
Montreal, Canada.
[illegible]
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
[illegible]
Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Burners, Oil and Gas
General Combustion Co. of Can., Ltd., Montreal, Que.
[illegible] W. S., New York City.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Cabinets, Oil
[illegible]

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery)
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUYERS' DIRECTORY

Union Carbide Co. of Can., Ltd., Welland, Ont.

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Electric Steel & Engineering Co., Welland, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Copper
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Electric Castings Co., Ltd., Orillia
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Nickel
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Semi-Steel
Davidson Mfg. Co., Thos., Montreal, Que
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que
Wright Mfg. Co., Lisbon, Ohio

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Convevor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill

Copper
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John Dundas, Ont
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Link-Belt Co., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong-Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co. Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont
Ford-Smith Machine Co., Hamilton, Ont
Toledo Machine & Tool Co., Toledo, Ohio.

BUYERS' DIRECTORY

Dies, Forging
Armstrong Whitworth of [illegible], Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
DeFoe, Fred C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
[illegible]
[illegible]
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Montreal, Canada.

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Giddings & Lewis Mfg. Co., Fond du Lac, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
[illegible]
Bertram & Son Co., Ltd., The John, Dundas, Ont.
[illegible]
[illegible]
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Stellinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
[illegible]
Cleveland Twist Drill Co., Cleveland, O.
[illegible]
Morse Twist Drill & Machine Co., New Bedford, Mass.
[illegible]
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
[illegible]

Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
[illegible]
Montreal, Que.
[illegible]
Ingersoll, Ont.
Standard Tool Co., Cleveland, Ohio.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
[illegible]
[illegible]
Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
[illegible]
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
[illegible]
Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
[illegible]
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
[illegible]
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
[illegible]
Northern Electric Co., Montreal, Que.
[illegible]

Elevating Trucks (See Trucks)
[illegible]

Elevators and Conveyors
[illegible]
Can. Fairbanks-Morse Co., Ltd., Montreal.
[illegible]
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Matthews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
[illegible]
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
[illegible]
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
[illegible]
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
[illegible]
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
[illegible]

File Handles
[illegible]

Files and Rasps
[illegible]

Filing Machines
[illegible]
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
[illegible]

Fire Extinguishers
[illegible]
Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph.

Flexible Shafts
[illegible]

Flux, Galvanizing
[illegible]

Fluxes, Welding
[illegible]

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
[illegible]
Dundas, Ont.
[illegible]

Forgings, Drop
[illegible]

Forgings, Hammer
[illegible]
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
[illegible]
N. S. Steel & Coal Co., Ltd., New Glasgow, N.S.
[illegible] Hamilton, Ont.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
[illegible]
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
[illegible]

Foundry Supplies
[illegible]
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
[illegible]

Fuel Oil Burning System
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
[illegible]
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
[illegible]

Furniture, Machine Shop
[illegible]

Gages, Comparator
[illegible]

Gages, Measuring (See Tool Work)
[illegible]

Gages, Recording
[illegible]

BUYERS' DIRECTORY

Gages, Snap, Thread and Cylindrical
Ackworthie, Ltd., John, Birmingham, Eng
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks Morse Co , Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co , of Canada, Ltd , Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co of Can., Lt Montreal, Que.
Atkins & Co , Inc , E C , Indianapolis,
Johansson Inc , C. E., Windsor, Ont

Gages, Thread
Ackworthie Ltd , John, Birmingham, Eng
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co , L S , Athol, Mass.

Garnet, Emery and Flint Paper and Cloth
Ritchey Supply Co , Toronto, Ont

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto, Ont.

Gaskets
Diamond State Fibre Co of Can., Ltd , Toronto, Ont.
Dunlop Tire & Rubber Goods Co , Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co of Can , Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gear Blanks
Canada Foundries & Forgings Co , Welland, Ont.
Can. Steel Foundries, Montreal, Que
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co , Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear-Cutting Machines
Bertram & Son Co , Ltd , The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co , Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co , Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co , Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can Link-Belt Co., Ltd , Toronto, Can
Hans Renold of Canada, Ltd , Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co , Ltd , Windsor, Ont.

Greases, Lubricating
Canadian SKF Co , Toronto, Ont
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg Co , Providence, R I
Can Fairbanks-Morse Co , Ltd , Montreal

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co of Can , Ltd , Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd , Toronto, Ont
Blount Co., J. G., Everett, Mass.
Lord Smith Machine Co Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill
Landis Tool Co , Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd , H W , Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U S. Electrical Tool Co , Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy Co , Toronto, Ont
Greenfield Machine Co , Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co , Cleveland, Ohio
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co , Ltd., The John, Dundas, Ont.
Holden Co , Ltd , Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co , J. G , Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co , Toronto Ont
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill
Wisconsin Electric Co , Racine, Wis

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co , Hamilton, Ont

Grinding Machines, Snagging
Blount Co , J. G , Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Surface
Garlock-Walker Mchy Co , Toronto, Ont
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd , H W , Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co , of Canada Ltd , Dundas Ont

Grinding Machinery, Tool Post
Foss Machinery & Supply Co , Geo F , Montreal, Que.
Gisholt Machine Co., Madison, Wis
Wisconsin Electric Co , Racine, Wis

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co , Toronto, Ont
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co , Erie, Pa
Morse Twist Drill & Machine Co , New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co , Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Riveting
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros Mfg Co., Inc., St. Louis, Mo

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hubs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke. Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy Co , Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke. Que.
Curtis Pneumatic Machinery Co., St Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke. Que.
Cleveland Pneumatic Tool Co., Toronto. Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can Consolidated Rubber Co., Ltd., Montreal, Que.
Can Foamite Firefoam Co., Hamilton, Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co., Ltd., Montreal, Q.

BUYERS' DIRECTORY

Jigs and Fixtures- (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis
Hamilton Engineering Service, Ltd., Hamilton, Ont
Rapid Tool & Machine Co., Lachine, Que

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn
Garlock-Walker Mchy. Co., Toronto, Ont
Morton Mfg. Co., Muskegon, Mich
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., [illegible], Indianapolis, I
Canada Machinery Corp., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich
Simonds Canada Saw Co., Montreal, Que

Knurl Holders
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que

Lamps, Electric
Federal Eng'r'ng Co., Ltd., Toronto, Ont
Northern Electric Co., Montreal, Que

Lathe Attachments
Canada Machinery Corp., Galt, Ont
Hendey Machine Co., Torrington, Conn
Lehmann Machine Co., St. Louis, Mo
Petrie, Ltd., H. W., Toronto, Ort.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis
Hendey Machine Co., Torrington, Conn

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Ill
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont
Blashill Wire Machy. Co., Ltd., Montreal
Sidney Machine Tool Co., Sidney, Ohio
Steinle Turret Machine Co., Madison, Wis

Williams Machinery & Supply Co., A. R., Montreal, Que

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio
Blount Co., J. G., Everett, Mass
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont
Jones & Lamson Machine Co., Springfield, Vt
McDougall Co., Ltd., R., Galt, Ont
National Acme Co., Cleveland, Ohio
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Ill
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont
Hendey Machine Co., Torrington, Conn
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Hendey Machine Co., Torrington, Conn
Lehmann Machine Co., St. Louis, Mo

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont
Gisholt Machine Co., Madison, Wis
Jones & Lamson Machine Co., Springfield, Vermont
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont

Lighting Fixtures
Northern Electric Co., Montreal, Que
Tallman Brass & Metal Co., Hamilton, Ont

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que
Rice Lewis & Son, Ltd., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I
Cleveland Twist Drill Co., Cleveland, O
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont

Metals, Alloy
[illegible] & [illegible] Co., Ltd., Montreal, Que
Brown's Copper & Brass Rolling Mill, Ltd., Toronto, Ont
Canada Metal Co., Ltd., Toronto, Ont
[illegible], Toronto, Ont
[illegible] Montreal, Que
[illegible] & [illegible] Co., Ltd., Toronto, Ont
Fisher Motor Co., Ltd., Orillia, Ont
Hoyt Metal Co., Toronto, Ont
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
[illegible] & [illegible], Montreal, Que
[illegible] Steel & [illegible] Co., Montreal, Que
[illegible] & [illegible], Ltd., [illegible], Ont
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metalite Cloth
Ritchey Supply Co., Toronto, Ont.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R I
Rice Lewis & Son, Ltd., Toronto, Ont

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Cleveland Milling Machine Co., Cleveland
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill
Terry & Co., John C., Birmingham, Eng

Milling Machines, Thread
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Cincinnati Milling Machine Co., Cincinnati, Ohio
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mchy. Co., Toronto, Ont
Hendey Machine Co., Torrington, Conn
Holly, R. S., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont
Williams Machinery & Supply Co., A. R., Montreal, Que

Milling Machines, Vertical
Cincinnati Milling Machine Co., Cincinnati, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Rockford Milling Machine Co., Rockford, Ill
Williams Machinery Co., A. R., Toronto, Ont

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont

Motors, Electric
[illegible], Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
[illegible], Toronto, Ont
Mussens [illegible] & Co., Montreal, Que
[illegible], Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont
Sturtevant Co., B. F., Boston, Mass
Williams Machinery Co., A. R., Toronto, Ont
Wagner Electric Co., [illegible], Wis

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que

Nail Machinery
[illegible] & [illegible] Co., Worcester, Mass

Nails and Staples
Steel Co. of Canada, Ltd., Hamilton, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont

Nickel Silver
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont

Nitrogen
L'Air Liquide Society, Toronto, Ont

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont
National Acme Co., Cleveland, Ohio

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto, Ont
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oxygen
Carter Welding Co., Toronto, Ont
Dominion Oxygen Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que
Graton & Knight Mfg. Co., Worcester, Mass
Guildford & Sons, Ltd., Halifax, N.S

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Graton & Knight Mfg. Co., Worcester, Mass
Guildford & Sons, Ltd., Halifax, N.S

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland

Patents
Fetherstonhaugh & Co., Ottawa, Ont
Marion & Marion, Montreal, Que

Pans, Wet and Dry
Frost Mfg. Co., [illegible]

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont
Wrought Iron Works, Galt, Ont

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pig Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa
Williams Machinery Co., A. R., Toronto, Ont.

Pipe Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng
Archibald & Co., Chas. P., Montreal, Q
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
MacKinnon Steel Co., Sherbrooke, Que.

Pumps, Automobile Tire
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Electric Steel & Engineering Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Victor Tool Co., Waynesboro, Pa.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
McCroskey Tool Corp., Meadville, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Respirators
Willson Goggles, Inc., Reading, Pa.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Inc., Hamilton, Ont.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock Walker M.ly. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati, Ohio.
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Second-Hand Machinery
(See Searchlight Section)
Petrie Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. B., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Ross Co., F. W., Buffalo, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Metal Working Machinery
Ross Co., F. W., Buffalo, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
[illegible] Ltd., Hamilton, Ont.
[illegible], Milwaukee, Wis.
[illegible], Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertrams & Sons, Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Fort Steel Machinery Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
[illegible] Smelting & Refining Co., Ltd., Montreal, Que.
[illegible]

Snap Flasks
[illegible]

Special Machinery and Tools
[illegible]
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
[illegible] Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Spectacles, Industrial
Willson Goggles, Inc., Reading, Pa.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steel Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold Chains of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
[illegible] Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries and Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Blooms and Billets
[illegible]

Steel, Cold-Rolled Strip
[illegible] Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
[illegible]
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
[illegible]
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Tanks
Can. Steel Wood Mfg. Co., Toronto, Ont.

Steel, Stainless
[illegible] Crucible Steel Co., Ltd., Toronto, Ont.
[illegible]
Vanadium Alloys Steel, Latrobe, Pa.

Steel Wire Rods
[illegible]

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
[illegible]
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., R. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
[illegible] & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal Ltd., Hamilton, Ont.

Tachometers
[illegible]
[illegible], Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
[illegible]
[illegible]

Tapping Machines and Attachments
[illegible]

Taps and Dies
[illegible]
Geometric Tool Co., New Haven, Conn.
[illegible]
International Machinery & Supply Co., Montreal, Q.
[illegible]
[illegible] Bedford, Mass.
[illegible]
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
[illegible]
[illegible] Mich.
National Acme Co., Cleveland, O.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
[illegible], Waterbury, Conn.

Thread-Cutting Tools
[illegible]
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threading Machines
[illegible]
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
[illegible]
[illegible]

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Ross Co., F. W., Buffalo, N.Y.

Tongs
[illegible]

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
[illegible]
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Sons, Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Tools, Small (See Machinists' Small Tools)
[illegible]
[illegible]
Geometric Tool Co., New Haven, Conn.
[illegible]
Streitlinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
[illegible] Tool Co., Detroit, Mich.
[illegible]

Tool Work
[illegible]
Crescent Machine Co., Ltd., Montreal, Q.

Torches, Blow
[illegible]

Trackwork, Railway
[illegible]

Trackwork, Manganese Steel
[illegible]

Transformers
[illegible]

Transmission Machinery
[illegible]
[illegible] Mchy. Co., Toronto, Ont.
[illegible]
Renold Chains of Canada, Ltd., Montreal, Que.

BUYERS' DIRECTORY

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Can. Atlas Crucible Steel Co., Toronto Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Maple Leaf Mfg. Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
National Steel Car Corp., Ltd., Hamilton, Ont.

Trucks, Industrial Motor
Maple Leaf Mfg. Co., Montreal, Que.
National Steel Car Corp., Ltd., Hamilton, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Tubing, Welded
International Nickel Co. of Can., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Tubing, Welded Steel
Tube Co. of Canada, Toronto, Ont.

Turbines, Water
Kennedy & Sons, Wm., Owen Sound, Ont.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Metal Workers'
Aikenhead Hardware, Ltd., Toronto, Ont.
Columbia Hdwe. Division, Cleveland, O.

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence, R.I.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Oliver Machy. Co., Grand Rapids, Mich.
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque, Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Barnes Co., Wallace, Bristol, Conn.
Diamond State Fibre Co., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.

Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Union Carbide Co. of Can., Welland, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.
Union Carbide Co. of Can., Welland, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Bristol, Conn.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Wrenches, Tap
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Wrought Iron Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Special Machinery Manufacturers

We have frequent requests from manufacturers in the United States for information regarding Canadian firms who are equipped to manufacture their line.

We would like to receive, therefore, the names of any firms who might be interested in inquiries of this kind. We desire the following information:

Name of firm and full address.

Description of shop and equipment.

Particulars regarding regular line, if any.

Class of work interested in securing and best equipped to handle.

Foundry equipment or connection.

This information will be filed and other necessary particulars forwarded to American manufacturers who are likely to be interested.

CANADIAN MACHINERY

143 University Ave. TORONTO

ELECTRICAL HEAT-TREATMENT

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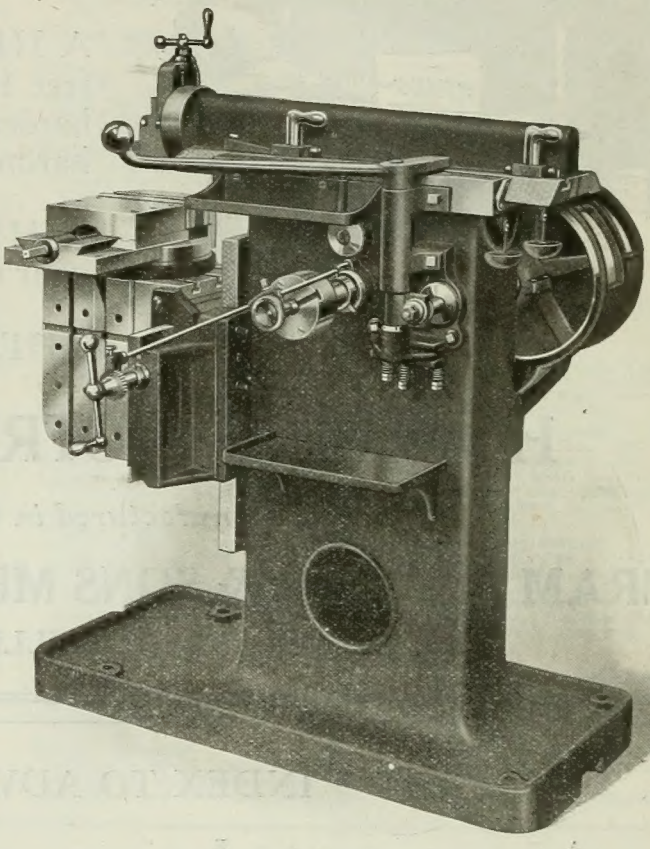

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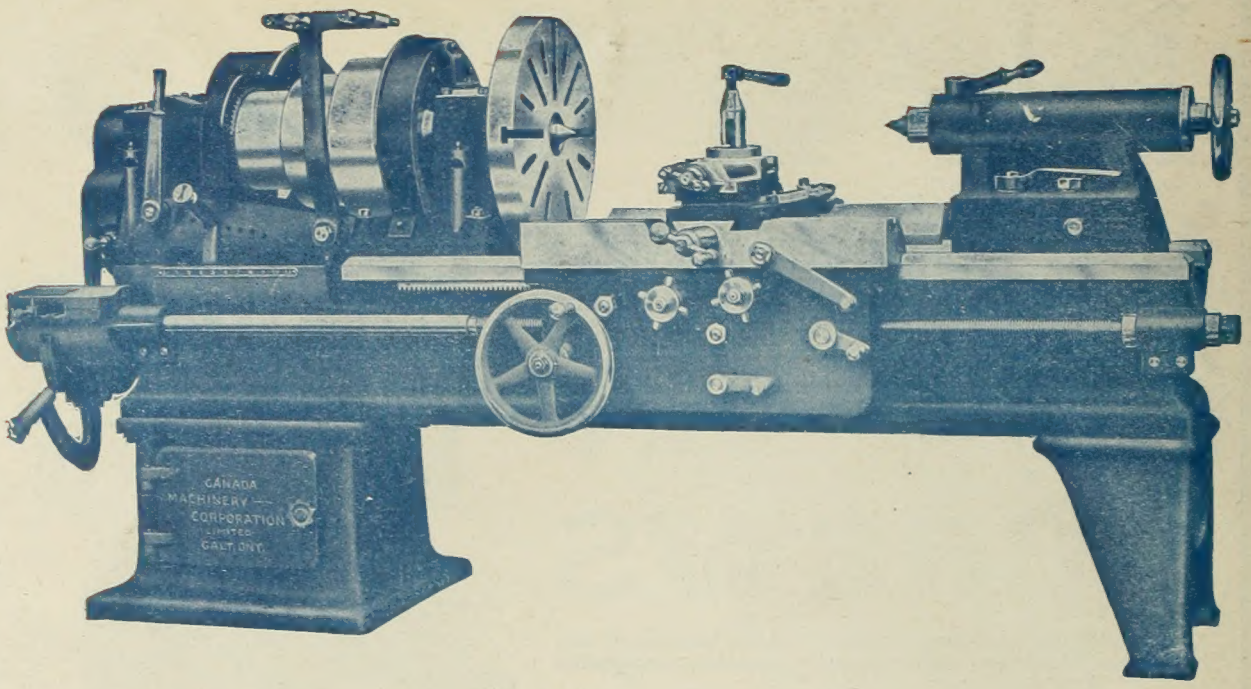

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